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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—No. CLIX

M. L. Fernald

II. Eastern North American Representatives of Alnus incana

(Plates 976–989)

In 1906, while he was a student with me, Dr. Harley H. Bartlett joined me in collecting at different stages of development through the season material of the Swamp Alders of northeastern Massachusetts, for it was quite apparent that the variations within this group were not satisfactorily disposed of merely by calling them all simply *Alnus incana* and *A. serrulata* or *rugosa*. With the cooperation of the late Professor J. Franklin Collins in Rhode Island, we assembled many collections but their final identification was interrupted by Bartlett's finishing his studies at Cambridge and the mass of material was stored, with the hope that one of those eclectic students, who specialize on our trees and shrubs, to the exclusion of herbs, would be interested to clarify the situation. More than quarter of a century later, when he was studying with me, Dr. Ernst C. Abbe, working primarily on morphological problems in the *Corylaceae* (*Betulaceae*), made a fresh start on the problem and, although he was obliged to cut short this special work, he had, before he finished, assembled striking evidence that the shrub or small tree, which in North America passes as the Eurasian *A. incana*, really differs from that species in very many important characters. Following up Abbe's unfinished studies, I undertook to conclude the quest and a decade or more ago wrote the introduction to the present paper.

Interrupted by more immediately pressing matters, I likewise failed to bring the study to completion. Now, after these repeated interruptions, I am again endeavoring to set the group in such order as I can establish in it. Fortunately but somewhat unhappily, I am faced by vastly more numerous, though more satisfactorily made, collections to deal with than Bartlett and I had before us 39 years ago, for wherever I have been, in Newfoundland, eastern Canada, New England, New York, Michigan or Virginia, my companions and I have had our eyes open for variations of the Alders. The present paper cannot, therefore, be called a hasty and off-hand study.

The name *Alnus incana* for the common Swamp Alder of the Labrador Peninsula, Newfoundland, eastern Canada and the more northeastern United States (PLATES 977–982) has been so thoroughly established, especially since Edward Tuckerman in 1843 so identified the northern shrub or small tree with leaves glaucous beneath, that to those who are more influenced by long-established usages than by precision its abandonment might seem mere iconoclasm. At the beginning, however, the name belonged strictly to a Eurasian tree and, of course, it must be retained for that variable but morphologically definite species. True *Alnus incana* (L.) Moench (PLATE 976) was so named because of the hoary (incanous) pubescence which so generally characterizes it; ordinarily its leaves are permanently quite gray with soft and velvety pilosity, as are the young branchlets and the axes of the inflorescences. The terminal lobes (FIGS. 5 and 6) of the bracts of the pistillate and fruiting aments (FIGS. 4 and 5) are depressed and slightly recurving or sometimes almost suppressed. This species is found in North America only in cultivation or where introduced from Europe, as formerly on the sand-hills near Provincetown, at the tip of Cape Cod, where it was originally planted and was abundant as late as 1919 (*Fernald & Long*, nos. 18,354, 18,355 and 18,360) but where, by 1944, none of it seems to have persisted.[1]

[1] The introduction of European plants for the reclamation of the sand-dunes back of Race Point Life Saving Station near Provincetown is typical of much of the practice in holding or reclaiming loose soils. The natural dunes of Cape Cod are very effectively and automatically reclaimed by the indigenous eastern North American *Ammophila breviligulata* Fernald and *Pinus rigida* (Pitch Pine), while the Alders of the dunes and hollows are endemic Americans. Nevertheless, the reclamation of the dunes of the old province-lands was largely attempted through the planting of imported

The eastern North American shrub or (rarely) small bushy so-called tree (PLATES 977–982) which erroneously passes as *Alnus incana* is not truly incanous. Its new branchlets and the axes of its inflorescences, are, with rare exceptions, glabrous or only very sparsely pilose and very gummy, having, when dry, a crackled or subverrucose surface. The oval or ovate to round-elliptical and usually coarsely undulate or doubly toothed leaves are less pubescent or glabrous beneath or, if strongly pilose, with usually rufescent pubescence. The pale cross-veins (between the strong parallel ribs) are, in mature foliage, coarse and prominent beneath (PLATES 977, FIG. 2, 978, FIG. 2, and 979, FIG. 4), freely confluent and forming a conspicuously scalariform and rugose pattern, the veins in European *A. incana* (PLATE 976, FIG. 2) being very slender and comparatively delicate. In the American species the pistillate aments are usually more numerous than in the European species; and the outer lobes of the summit of each bract of the pistillate cone are suberect or arching and prolonged (PLATES 977, FIG. 3, and 978, FIGS. 3 and 5). That the so-called *A. incana* of North America is really very different from true Eurasian *A. incana* is quite obvious; but for clarity of discussion this American shrub, which for more than a century has erroneously passed with us as Old World *A. incana*, may be temporarily designated SPECIES NO. 1.

All the characters above noted are such as can be seen in a good herbarium. Others of equal significance are not often there displayed. Eurasian *Alnus incana* is a large shrub or, more often, a considerable tree, up to 35 or even to 85 feet high and with single erect trunks up to 3 feet in diameter, the cortex lustrous and whitish-gray. "In . . . Europe . . . in the south . . . sometimes attaining a height of seventy feet; it is the common Alder of Siberia and southeastern Asia [this

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European White Alder, Scotch Pine and Scotch Broom; but the Broom is there now relatively unimportant, the Scotch Pine is secondary to the native Pitch Pine, and the European Alder has not survived. That is as it should be: the climate of the dunes of western Eurasia, with prevailingly western winds off the Atlantic, is so unlike the dry and hot summer conditions at the eastern border of North America, that western European shrubs are too much handicapped. Some years ago I received a call from an American soil-conservator who stated that he was going on a federal government mission to India, to find some Asiatic species which would control erosion in our "dust-bowl". A few days later I had a brief visit from a prominent botanist of India, who had been sent to America by his government to see if in our "dust-bowl" he could secure some plant to control wind-erosion in India. Tra-la-la!

sometimes separated], . . . a stately tree fifty or sixty feet in height, with a trunk often two or three feet in diameter"—Sargent, Silva, ix. 69, in footnote (1896). "Strauch oder bis 10 (25) m hoher Baum. . . . Rinde glatt, glänzend weissgrau" —Hegi, Ill. Fl. Mitt.-Eu. iii. 89, with illustration of the arborescent habit as fig. 483. "Arbre à écorce lisse, d'un gris blanc"—Rouy, Fl. France, xii. 261 (1910); "meist 6 bis etwa 23 m hoch, in der Tracht der *A. glutinosa* ähnlich, aber meist niedriger, mit ziemlich dichter Krone. Stamm glatt mit hellgrauer Rinde"—Ascherson & Graebner, Synop. Mitteleur. Fl. iv. 423 (1911). Certainly the North American shrub or bushy "tree", which for a century or more has passed as *A. incana* (our SPECIES NO. 1), does not have sufficiently erect or solitary trunks to rank as a real tree; otherwise it would have been included among the trees in such compendious works as Sargent's *Silva* and his *Manual of the Trees of North America* and in Britton's *North American Trees*, in none of which is it included. If a tree, it should also be in Sudworth's *Check List of the Forest Trees of the United States*. Rightly enough, however, *A. incana* is mentioned by Sudworth only in a footnote as "a shrub", "as it occurs in northeastern North America and United States" (Sudworth, p. 80). In a footnote Sargent, Silva, l. c., refers to it (as *A. incana*) in the following terms: "In North America, where it is the common Alder of swamps and river-banks in the northeastern parts of the continent, forming dense shrubby thickets rarely more than ten or twelve feet high"; while F. A. Michaux, describing it as his *A. glauca* and comparing it with *A. serrulata*, said "c'est-à-dire qu'on en trouve souvent des individus qui ont de 18 à 20 pieds . . . de hauteur, sur environ 3 pouces (12 centim.) de diamètre". And surely the cortex of our northern shrub is never *whitish gray*, the color so consistently stated by Eurasian botanists for their *A. incana*. The thin cortex of ours is a warm purple-black, purple-brown or gray-brown, with conspicuous elongate white lenticels (PLATE 980, FIG. 2). "L'écorce qui couvre le tronc, ainsi que les branches secondaires, est d'une teinte brune très-foncée" (Michx. f. in describing his *A. glauca*); "bark gray brown with lighter horizontal markings" (Mathews, Field Book Am. Trees and Shrubs, 126). "A shrub 8–20 feet high; the stem sometimes 3–4 inches in diameter, with a smooth brown bark"—

Torrey, Fl. N. Y. ii. 202 (1843). In fact, so dark is the bark that, when the younger Michaux published his *Alnus glauca*, with "*foliis subrotundò-ellipticis, duplicatò-serratis, subtùs glaucis*", he gave our shrub of "les États du New-Hampshire, Massachusetts et de Vermont" which has the foliage so "vert pâle et comme bleuâtre, ce qui les fait reconnoître au premier abord", the English name "*BLACK ALDER*"; whereas in Europe *A. incana* is frequently called "WHITE" or "GRAY ALDER". Furthermore, in Europe witches' brooms (*Hexenbesen*) are frequent on *A. incana*, sometimes as many as 100 on a single tree; our dark-barked northeastern shrub, Professor Faull informs me, has never been known to produce them; and Professor Arthur Stanley Pease tells me that his students in Latin, familiar with the shrubbiness of alders in eastern North America, always have a great laugh as they read passages (at least 11 of them) by the Latin poets, telling of ships built of alder! Surely no argument beyond the mere facts and the plates is needed to show that we have been far astray in calling our northern Swamp Alder the same as the Eurasian *A. incana!*

The only other indigenous Swamp Alder of temperate North America, excluding the quite definite autumn-flowering *Alnus maritima* (Marsh.) Muhl., is the generally more southern shrub (PLATE 983–989) with the white lenticels of the bark much smaller than in SPECIES NO. 1 or often very obscure (PLATE 985, FIG. 5); the leaves of a generalized obovate type, mostly subcuneately narrowed (but sometimes more rounded) to base, usually with regularly or subuniformly fine-serrulate margins, with cross-veins beneath (PLATES 984, FIG. 4, 985, FIG. 4, 987, FIG. 4 and 988, FIG. 3) more delicate and less conspicuous, the lower leaf-surfaces fulvous-green to reddish, glabrous, glabrate or reddish-pubescent; the axis of the pistillate inflorescence (PLATES 983, FIGS. 3 and 4, 985, FIG. 3, 986, FIG. 3, 988, FIG. 4, and 989, FIG. 4) commonly with right angles or strongly geniculate bends. The outer terminal lobes of the cone-bract (PLATE 986, FIG. 4) are low and broadly rounded. This shrub, the northern limits of which interlock with the southern outposts of SPECIES NO. 1, long passed correctly as *A. serrulata* (Ait.) Willd.; but, especially since Karl Koch in 1872, Coulter in 1894 and Sargent's Silva (1896), it has recently been incorrectly passing as *A. rugosa* (Du Roi) Sprengel. Since the

latter name must be considered in connection with Species no. 1, it will make for clarity, until the application of the various names is investigated, to designate the more southern shrub as Species no. 2.

Almost from the start, at least beginning with Willdenow in 1796, the names *rugosa* and *serrulata*, whether under *Betula* or *Alnus*, were hopelessly confused. Regel at last got them clearly separated but, depending chiefly on variable leaf-outline and -pubescence, without noting the striking differences of bark and inflorescences, he maintained them both as variations of one species. With the two eastern American species defined as Species nos. 1 and 2 and clearly shown in the plates, we may proceed to examine the specific names published for them, somewhat in chronological order, that we may settle their correct application. In so doing I am omitting the several *nomina nuda* of Steudel and others, undefined names which by various authors have been placed in the vague synonymy of one or another of the properly defined ones.

The first of these two American species defined was *Betula Alnus* (*rugosa*) Du Roi, Obs. Bot. p. xxxii (1771). The original diagnosis and discussion of the shrub growing in the botanic garden of Harbke near Brunswick was as follows:

> 5. BETULA ALNUS (*rugosa*) foliis mucronatis acute serratis, subtus venoso-rugosis.
> *Germ.* Nordamerikanische Eller.
> Habitat in America septentrionali.
> Species horti Harbeccensis *foliis* ovatis mucronatis, acutius serratis et angustioribus, quam in B. Alno incana, viridibus glabris, subtus venis albidis rugosis. *Rami* tenues, cortice nigricante. E semine misso culta arbor in horto nondum adhuc floruit.

This was followed by the fuller account in Du Roi's detailed Die Harbkesche wilde Baumzucht, i. 112 (1771):

> 3. BETULA Alnus (rugosa) foliis mucronatis acute serratis, subtus venoso-rugosis.
> The American Alder.
> Aune d'Amerique septentrionale.
> Die Nordamerikanische Eller.
> Sie unterscheidet sich deutlich von den beiden vorigen, und ist hier aus Saamen gezogen, welcher aus Nordamerika geschickt worden ist.

Die **Blätter** erscheinen schmaler als bei den vorhergehenden, und in den mehresten an vier Zoll Länge und zwei Zoll Breite. Sie sind oval zugespizt, am Rande scharf und fein gezahnt, auf der oberen Fläche hell grün und glatt, und auf der unteren ebenfals hellgrün. Auf der lezteren lauft der Länge nach eine weissgrüne erhabene Ader hin, welche in schrägen Linien nach dem Rande aus etwas feinere Nebenäste Paarweise gegen einander über ausschicket, und aus diesen lezteren kleinen Adern gehet ein Gewebe noch kleinerer Adern heraus, die das Blatt etwas runzlicht bilden.

Die äussere Rinde ist dunkelgrau an alten Zweigen, an iungen aber grün.

Ehrhart, improving on the trinomial nomenclature of Du Roi, redescribed the shrub growing in the Harbke Garden as *Betula rugosa* (Du Roi) Ehrh. Beitr. iii. 21 (1788).

6. *Die Haseleller.*
Betula rugosa.
Betula gemmis elevatis, obtusis; foliis ovatis, acutis, repando-angulatis, serratis, nudis, superne glabris, subtus venoso-rugosis; racemis subtristrobilis, aphyllis.
Ihr Vaterland ist Nordamerika.
Die Plantage zu Herrnhausen, die Gärten zu Harbke, Destedt und mehrere haben sie.
Betula Alnus rugosa. Duroi baumz, v. i, p. 112.

Sprengel, too, in transferring the species to *Alnus*, in Syst. iii. 848 (1826), was equally clear:

*rugosa** 8. A[lnus] foliis basi rotundata ovato-oblongis acutis duplicato-denticulatis subtus rugulosis, axillis venarum villosis. *Amer. bor.*

but Sprengel made the serious mistake of suggesting identity with the Peruvian *A. acuminata* HBK.

From the original accounts of Du Roi, Ehrhart and Sprengel, then, it is clear that *Alnus rugosa* rests upon material cultivated in Germany and having dark or blackish bark, leaves ovate or oval, acutish, rounded at base, doubly toothed, green and glabrous or glabrescent beneath, a leaf which so resembles that of *Corylus* as to suggest to Ehrhart the name "*Haseleller*" (Hazel-Alder). These descriptions are so vivid for the common extreme of the shrub of northeastern America which has erroneously passed as the European *A. incana*, var. *hypochlora* Call.[1], that it is doubly reassuring to see a photograph (our PLATE 979, FIG. 1) of a speci-

[1] As by Fernald in RHODORA, xxiii. 257 (Feb. 27, 1922).

men distributed by Ehrhart as his *Betula rugosa* and coming from the Harbke Garden. The photograph, for the use of which I am indebted to Professor Alfred Rehder and the Arnold Arboretum, was taken by Professor Rehder at the Botanical Museum at Berlin-Dahlem; and, since the destruction of that invaluable herbarium, it is a most fortunate photograph to have. The foliage shown is young first-year leaves and is closely matched by the leaves on young and vigorous sprouts of our greener-leaved so-called "*A. incana*, var. *hypochlora*". Surely no one, familiar with the obovate and usually cuneate-based leaf of *A. serrulata*, would think of matching the latter with the authentic foliage from the Harbke Garden. Neither would they call our *A. serrulata* "Hazel-Alder". That name is wholly appropriate for our shrub (SPECIES NO. 1) which has been passing as *A. incana*. A characteristic leaf was shown by Regel in his *Monographia Betulacearum* in Nouv. Mém. Soc. Nat. Mosc. xiii. 165, t. xi. fig. 8—repr. as Mon. Bet. 107 (1861)—of the shrub "in den Gärten Europas" and which Regel, with remarkable conservatism, called *A. glutinosa*, lusus *rugosa!* Regel in 1861 stated that the shrub was widely grown in the botanical gardens of Europe and he identified with it the *A. hybrida* of Alexander Braun in Reichenb. Ic. Fl. Germ. xii. 3, t. 630, fig. 1292 (1850), which had been found wild in various parts of Germany and in Bohemia. Such a shrub, from a wild habitat in Wittenberg, was distributed in *Baenitz. Herb. Dendrol.* no. 1214, as *A. rugosa*. This material, unlike the Ehrhart specimen, shows mature fruiting branches with the characteristic cones and the typical foliage of fruiting branches of our greener-leaved "*A. incana*". It is shown in our PLATE 977. Native American specimens, almost like it in every respect, are shown in PLATE 978.

Confusing as it may temporarily prove, there seems to be no escape from taking up for the North American shrub which passes as *Alnus incana*, our SPECIES NO. 1, its earliest name, A. RUGOSA (DuRoi) Spreng.

Chronologically, the names of Humphrey Marshall, Arb. Am. 20 (1785), have to be noted. The first, "BETULA-ALNUS glauca. *Silver-leaved Alder*" of "low marshy ground", had no diagnosis whatever but from its names may be inferred as being the common northern variety of *A. rugosa*, which reaches northeastern

Pennsylvania, a species which had already been described by DuRoi (1771) and which in 1813 F. A. Michaux properly described and illustrated, with no reference to Marshall, as *A. glauca*. Marshall's second species, "BETULA-ALNUS maritima, *Sea-side-Alder*", was sufficiently defined as to give an unquestioned basis for *A. maritima* (Marsh.) Nutt., a clear-cut autumn-flowering species which we are not here discussing. His third had no good description, merely very brief and inconclusive comments. though geographically it was obviously intended for *A. serrulata* (Ait.) Willd., our SPECIES NO. 2. This was

> BETULA-ALNUS rubra. *Common Alder.*
> This grows very common in most parts of Pennsylvania. The leaves are broader than the other kinds and rough or wrinkled. This flowers in the spring, and perfects its seeds in the fall.

From its abundance in Pennsylvania Marshall's species, as said, should be some form of *Alnus serrulata*. The leaves "broader than the other kinds and rough or wrinkled" is inconclusive but there are plenty of broad-leaved variations of *A. serrulata*. Tuckerman interpreted it as unmistakable *A. serrulata* and described *A. rubra* (Marsh.) Tuckerm. in Am. Journ. Sci. xlv. 32 (1843), with leaves obovate and with *Betula serrulata* Ait. and *A. serrulata* (Ait.) Willd. as synonyms, Tuckerman giving the naïvely nationalistic explanation:

> The name of our own botanist should have the priority: his description, though short [he might have said inconclusive], notices the most striking features of the species, and cannot be mistaken. The A. rubra of Bongard [1833], is many years later [than *Betula-Alnus rubra*]. Add to this, that Marshall's name is far more expressive and apt than that of Aiton [1789].

Nevertheless, *Alnus rubra* Bongard (1833), the Pacific North American species, has right of way and under present-day rules no other species can validly bear the same name, even though its name-bringing typonym was earlier. *A. rubra* (Marsh.) Tuckerm. (1843) is fortunately, in view of its vague origin, a later homonym.

The next name, chronologically, was *Betula serrulata* Aiton, Hort. Kew. iii. 338 (1789). Aiton's diagnosis was brief but its characterization of the leaf definite:

serrulata. 11. B. pedunculis ramosis, foliis obovatis acutis; venis et axillis venarum subtus villosis, stipulis ovalibus obtusis.
Notch'd-leaved Alder Tree.
Nat. of Pensylvania.
Cult. 1769, by Peter Collinson, Esq.

That *Betula serrulata* was our SPECIES NO. 2 (especially as shown in PLATE 983) is clear from the *obovate*, *acute* leaves; but, with wholly vague conceptions of our two species, European authors promptly produced confusion of names, like most botanists who study names to the exclusion of the plants! Thus, Willdenow, in his Berlinische Baumzucht, 45 (1796), took up *Betula serrulata* with Aiton's original diagnosis of 1789 and placed unquestioningly in its synonymy *B. rugosa* Ehrh. (1788), which went back to Du Roi's original publication of 1771. And later, when he made the combination *Alnus serrulata* (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805), Willdenow merged with this species, correctly described "foliis obovatis", the above discussed *Betula rugosa* "foliis ovatis . . . repando angulatis". Further augmented by the failure of André Michaux (1803) definitely to distinguish our two species, the mixing of the two, started by Willdenow in 1796, became general and, consequently, has resulted in the recent erroneous and highly uncritical application of the name *A. rugosa* to the abundantly different and usually more southern *A. serrulata.* Michaux's confusion of the two may be stated as follows: in his Flora Boreali-Americana, ii. 181 (1803) he described *Betula rugosa* (American "*incana*") as *B. serrulata* "foliis lato-ovalibus" and then added the

Obs. Folia saepe obovalia, interdum subglanduloso-repanda, basi semper acuta,

the observation referring to the relatively southern *A. serrulata.* Michaux gave the range from "Pensylvania ad Carolinam", the specimen in his Herbarium at Paris, which I examined in 1903, being of the southern species. Somewhat surprisingly, André Michaux, who had explored eastern Canada as far north as Rupert River and west to Lake Ontario and who knew northern New England, gave no intimation in his Flora that there is any Alder of this group north of his "Pensylvania ad Carolinam". Having collected *A. serrulata* in that area, he possibly did not further feel any special interest in the group; at any rate,

the only Alder he noted from Canada in his Flora was *Betula crispa* Ait. More probably, however, northern material was lost before the writing of the Flora Boreali-Americana. It is fairly clear that Michaux recognized the northern species as distinct from the southern, for in his Journal—*Journal of André Michaux. 1787–1796. with an Introduction and Notes*, by Charles Sprague Sargent, Proc. Am. Phil. Soc. xxvi. no. 129 (1888)—he noted, among the plants seen on his trip up the Saguenay and across to Lake Mistassini, "Alnus glauca stipulis lanceolatis" (Sargent, l. c. 75, under "Le 15" of August). To be sure, Sargent (l. c.) identified Michaux's *Alnus glauca* as *Betula pumila*, but Michaux knew the difference, for on the 19th of August on "la riv. ditte Mistassin", he specially noted *Betula pumila*.[1]

F. A. Michaux, the son, carried the confusion still further, describing *A. serrulata* "foliis duplicatò-serratis, ovalibus, acutis"[2], stating that it is found in the Northern, Central and Southern States ("on la trouve aussi bien dans les États du Nord que dans ceux de Centre, du Sud et de l'Ouest"), and illustrating the round-based doubly serrate leaf of typical *A. rugosa*, already discussed. With such inauspicious beginnings, it is little to be wondered at that the correct applications of the names *A. rugosa* and *A. serrulata* have been hopelessly confused by those who have relied more upon "the books" than upon the morphological characters of the plants.

The next specific name to consider is *Alnus glauca*. Although the undefined name "Betula-Alnus glauca" had been used by Marshall in 1785, that publication was not cited by F. A. Michaux when he described and illustrated his own *Alnus glauca*, Michx. f. Hist. Arb. Forest. Am. Sept. iii. 322, t. 4, fig. 2 (1813). The diagnosis and figure are unequivocal, the former being

[1] Unfortunately, most others of Sargent's identifications of Michaux's plants need correction. For instance, "Sparganium natans", collected on the same trip, was identified by Sargent (p. 75) as *S. minimum*. Michaux's collection, labeled "Hab. in Amnibus à Québec ad Lacus Mistassins", was the type of *S. angustifolium* Michx. Fl. Bor.-Am. ii. 189 (1803), the only species of the genus in the *Flora*. Similarly Michaux's Journal recorded as growing with the *Sparganium* and near the *Alnus* "Alisma subulata", which Sargent identified as "*Alisma Plantago*, L. var. *Americanum*, Gray". But Michaux knew the broad-leaved plant and in his Flora, i. 218, had it as *A. Plantago*. He there included *A. subulata* L. from Florida only, the plant now known as *Sagittaria subulata* (L.) Buchenau. The plant of Canada, which Michaux mistook in the field for *Alisma subulata* L., is the type of *Sagittaria graminea* Michx. Fl. Bor.-Am. ii. 190 (1803).

[2] Michx. f., Hist. Arb. Forest. Am. Sept. iii. 320, fig. 1 (1813).

ALNUS *glauca, foliis subrotundò-ellipticis, duplicatò-serratis, subtus glaucis,*

the species said to be unknown in the South, very rare in the Middle States but abundant in New Hampshire, Vermont and Massachusetts ("Cette espèce d'Aulne qui ne se trouve pas dans les États du Sud, qui est assez rare dans ceux du Milieu, est, au contraire, plus multipliée dans les États du New-Hampshire, Massachusetts et de Vermont"). The description, figure and abundance in northern New England clearly indicate the common shrub of the North with gray or glaucous lower leaf-surfaces (PLATES 980 and 981), which erroneously and almost universally passes as the Old World *A. incana*, the only possible excuse for such an interpretation being the glaucous lower surface of the leaves. This familiar shrub is, of course, one of the extreme and usually most northern variations of *A. rugosa*.

In 1894, the late Dr. Britton collected on Staten Island fruiting material from a "large alder in swampy woods, . . . ; these were at the time referred to *Alnus incana*, though with doubt, inasmuch as the height of the tree seemed much too great for that species, and the large, strongly pointed leaves seemed also to be different from those of any specimens of *incana* that I had seen. The woods in which this tree grew were cut away soon after my collection was made, and, though a search was made in the vicinity for other plants, I was never able to find another specimen".—Britton in Torreya, iv. 124 (1904). Since, however, the late Eugene P. Bicknell subsequently found somewhat similar shrubs on Long Island, the Staten Island specimen was made the type of *Alnus noveboracensis* Britton in Torreya, l. c. (1904) our PLATE 995. It was more fully described and illustrated in Britton, N. Am. Trees, 264, fig. 224 (1908), but in Britton & Brown, Ill. Fl. ed. 2, i. 613 (1913) it was noted after "*A. rugosa*", i. e. *A. serrulata*, with the justifiable comment: "It may be a race of this species". The latter disposition of it seems about right; it is an occasional and rather marked extreme in the broad range of *A. serrulata*, from Maine to Georgia, Tennessee and Louisiana. Unfortunately the type from Staten Island, which I have before me through the courtesy of Dr. Gleason, had been badly pressed, poorly mounted and seriously broken. It is, therefore, not a very good subject for illustration, but in PLATE 985 Dr. Schubert has cannily covered the most broken parts.

Numerous varietal names must be considered but, since they do not disturb the specific epithets which we must apply to our two native species, their discussion will be deferred until the varieties of the two species are defined.

As I understand our spring-flowering native Alders of this group they fall into the two species following.

Cortex of trunks and older branches bearing abundant linear transverse whitish lenticels up to 7 mm. or more long; axis of young or flowering inflorescence arching, without right angles, the pistillate branch or branches (in monoecious inflorescences) then drooping and appearing to be below the staminate ones; leaves ovate, oval, subelliptic or rounded, broadest below or near the middle, with rounded to subcordate bases, oftenest double-serrate or -dentate, often repand-undulate, not at all or only slightly glutinous, the mature blades with the cross-veins beneath prominent and forming ladder-like reticulation between the main lateral veins ..... 1. *A. rugosa.*

Cortex with fewer and shorter orange to gray lenticels or these obsolescent; axis of young inflorescence with 1 or more abruptly geniculate or right-angled bends, the pistillate branches erect or strongly divergent and thus appearing to be above the drooping staminate ones; leaves obovate or obovate-elliptic, broadest above middle, cuneate to but slightly rounded at base, simply serrulate, only exceptionally strongly undulate, the expanding ones glutinous, often aromatic, the mature blades with the lower surface delicately or finely reticulate or with only weak cross-veins ..... 2. *A. serrulata.*

1. A. RUGOSA (Du Roi) Spreng. Syst. iii. 848 (1826).—The following varieties and forms are recognized.

a. Leaves green or fulvous, not glaucous, beneath.
  Lower surfaces of leaves glabrous or promptly glabrate, only the principal veins or their axils sometimes permanently pilose ..... Var. *typica.*
  Lower surfaces of leaves permanently soft-pilose or subvelutinous (to touch) ..... Forma *Emersoniana.*
a. Leaves glaucous or whitened beneath ..... *b.*
  b. Lower surfaces of leaves glabrous or promptly glabrate.
    Leaves ovate or oval to rounded-elliptic, with low toothing ..... Var. *americana.*
    Leaves narrowly elliptic to ovate-lanceolate, lacerate or jagged-toothed ..... Forma *tomophylla.*
  b. Lower surfaces of leaves densely soft-pilose or subvelutinous (to touch) ..... Forma *hypomalaca.*

A. RUGOSA, var. TYPICA H. Winkl. in Engler, Pflanzenr. iv[61]. 119 (1904), as to name of the type. *Betula Alnus* (*rugosa*) Du Roi, Obs. Bot. 31 (1771) and Harkb. Wilde Baumz. i. 112 (1771). *Betula rugosa* (Du Roi) Ehrh. Beitr. iii. 21 (1788). *A. serrulata* sensu Michx. f. Hist. Arb. Forest. Am. Sept. iii. 320, fig. 1 (1813), not Willd. (1805). *A. rugosa* (Du Roi) Spreng. Syst.

iii. 848 (1826); Callier in Mitteil. Deutsche Dendr. Gesellsch. 1918: 114 (1918), in small part only (a bad mixture). *A. latifolia* Desf. Cat. Pl. Hort. Par. ed. 3: 352 (1829), *nomen nudum*, cited in synonymy of the next by Spach (1841). *A. hybrida* A. Br. ex Reichenb. Ic. Fl. Germ. xii. 3, t. 630, fig. 1292 (1850). *A. serrulata*, β. *macrophylla* Spach in Ann. Sci. Nat. sér. 2, xv. 206 (1841). *A. macrophylla* Desf. ex Spach, l. c. in synonymy (1841). *A. autumnalis* Hartig. Naturgesch. Forste, Kulturpfl. 337 (1850). *A. glutinosa*, δ. *serrulata*, lusus c. *rugosa* (Du Roi) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 165, t. xi. figs. 8–10—repr. as Mon. Bet. 107 (1861). *A. serrulata* β. *rugosa* (Du Roi) Regel in DC. Prodr. xvi². 188 (1868). *A. glutinosa*, var. *autumnalis* (Hartig) Ktze. Rev. Gen. ii. 638 (1891). *A. incana*, var. *hypochlora* sensu Fernald in Rhodora, xxiii. 257 (Feb. 27, 1922), not Callier (1918).—Low grounds, western Nova Scotia to northern Michigan, south to southern New England, locally to northern and eastern Pennsylvania and northern Indiana. The following, mostly distributed as *A. incana* and selected from more than 300 specimens before me, are characteristic. Nova Scotia: Cedar L., Digby Co., *Fernald & Long*, no. 23,781 (as *A. incana*, var. *hypochlora*); Eel L., Yarmouth Co., *F. & L.*, no. 23,782 (as *A. incana*, var. *hypochlora*). Maine: Milford, Penobscot Co., *Fernald & Long*, no. 13,474 (as *A. incana*, var. *hypochlora*); Rowe P., Pleasant Ridge, Somerset Co., Sept. 10, 1909, *J. F. Collins;* New Sharon, Franklin Co., July 23, 1904, *Knowlton* (as *A. serrulata*); Whitney P., Oxford, Oxford Co., July 12, 1914, *Weatherby;* Mud P., Greenwood, Oxf. Co., June 12, 1931, *Bill, Eaton, Fernald, Griscom & Hunnewell;* Washington, Knox Co., *J. G. Jack*, no. 3398 (as *A. incana*, var. *hypochlora*); Isle au Haut, Knox Co., Aug. 11, 1918, *Kidder* (as *A. incana*, var. *hypochlora*), *A. F. Hill*, no. 1652; Waterville, Kennebec Co., July 5, 1904, *Knowlton;* Livermore, Androscoggin Co., 1879, *Kate Furbish;* Baldwin, Cumberland Co., *Fernald & Long*, no. 13,476; Limington, York Co., *F. & L.*, no. 13,475; Cape Neddick, York Co., *J. G. Jack*, nos. 3388 and 3392. New Hampshire: Lebanon, Grafton Co., June 12, 1920, *Fernald, Hunnewell and R. W. Blanchard;* Hookset, Merrimac Co., Aug. 2, 1925, *C. F. Batchelder;* Durham, Strafford Co., Sept. 7, 1918, *Knowlton:* Derry, Rockingham Co., Aug. 25, 1917, *C. F. Batchelder;* Nashua, Hillsborough Co., *Robinson*, no. 800; Jaffrey, Cheshire Co., *Robinson*, no. 156. Vermont: Essex Junction, Chittenden Co., *S. F. Blake*, no. 2218; Middlebury, Addison Co., Sept. 25, 1880, *Brainerd* (as *A. serrulata*); West Rutland, Rutland Co., *Eggleston*, no. 3211; Townshend, Windham Co., June 2, 1912, *L. A. Wheeler;* Manchester, Bennington Co., *M. A. Day*, no. 163. Massachusetts: Emerson Point, Rockport, Essex Co., *L. B. Smith & R. G. Gates*, no. 1009; West Manchester, Essex Co., June 7, 1913, *F. T.*

Hubbard; Plum Island, Essex Co., *White & St. John*, nos. 528 and 543; Winchester, Middlesex Co., *Fernald & Bartlett*, no. 7; West Cambridge, Mid. Co., *F. & B.*, no. 2; Concord, Mid. Co., July, 1857, *E. S. Hoar;* Boxboro, Mid. Co., *Hubbard & Torrey*, no. 477; West Roxbury, Suffolk Co., April 9 and September 11, 1906, *F. F. Forbes* (as hybrid of *A. incana* and *A. rugosa*); Dorchester, Suf. Co., Sept. 23, 1919, *Kidder*, Brookline, Norfolk Co., March 19, Sept. 9 and Nov. 24, 1902, *F. F. Forbes;* Dedham, Norfolk Co., Sept. 8, 1895, *E. F. Williams;* Hanson, Plymouth Co., *Knobloch, Smith & Stebbins*, no. 2562; North Tisbury, Martha's Vineyard, Dukes Co., Oct. 3, 1912, *Bicknell;* Copaum P., Nantucket, Nant. Co., June 8, 1908, *Bicknell;* Hardwick, Worcester Co., Aug. 9, 1935, *C. F. Batchelder;* Sutton, Worc. Co., *Anderson, Smith & Weatherby*, no. 2446; Montague, Franklin Co., May 11, 1912, *Wheeler & Wiegand;* Chicopee, Hampden Co., *Murdoch & Torrey*, no. T 435; Smith's Ferry, Northampton, Hampden Co., Aug. 10, 1912, *F. F. Forbes;* Proven Mt., Agawam, Hampden Co., May 18, 1913, *Knowlton & White;* North Adams, Berkshire Co., May 14, 1915, *Knowlton;* Lenox, Berks. Co., Aug. 24, 1902, *Hoffmann;* Centre P., Becket, Berks. Co., Sept. 22, 1904, *Hoffmann;* Mount Washington, Berks. Co., Sept. 10, 1915, *Floyd.* Rhode Island: Cumberland, Providence Co., May 30, 1911, *Knowlton;* East Providence, Prov. Co., *J. F. Collins*, no. 15,010. Connecticut: Middlebury, New Haven Co., April 25 and July 16, 1897, *Shepardson;* Oxford, N. H. Co., April 12, 1888 and Sept. 17, 1897, *Harger.* New York: Black Lake, St. Lawrence Co., *Fernald, Wiegand & Eames*, no. 14,251; Canton, St. L. Co., *Phelps*, no. 373; Sandy Creek Township, Oswego Co., *Fernald, Wiegand & Eames*, nos. 14,249 and 14,250; Spruce P., Black Lake Forest, Orange Co., *Raup*, no. 7589; Taughannock Ravine, Ulysses, Tompkins Co., *Eames & Wiegand*, no. 11,930. Pennsylvania: Kenney's P., e. of West Auburn, Susquehanna Co., *Wahl*, no. 489; 7 miles s. of Moscow, Lackawanna Co., *Randolph & Randolph*, no. 57; Martic Forge, Lancaster Co., Aug. 16, 1914, *J. F. Collins;* Crawford Co., *Dickey*, no. 23. Michigan: Isle Royale, Keweenaw Co., *Cooper*, no. 7; Keweenaw Co. (without stated localities), Oct., 1904, *Farwell* (some as *A. incana*, var. *americana*, some as var. *glauca*); north of St. Ignace, Mackinac Co., *Benner*, no. 6715. Indiana: south of Tamarack, Porter Co., *Deam*, no. 8064.—Spread from cultivation in Europe. Plates 977–979.

Var. typica, forma **Emersoniana,** f. nov. (tab. 979, fig. 4), foliis subtus piloso-tomentulosis, pilis plus minusve rufescentibus. —*A. incana* sensu Emerson, Trees and Shrubs in Mass. i. 251, with plate (1875), not (L.) Moench.—Differing from typical *A. rugosa* in having a permanently and usually densely pilose-tomentulose lower surface, the pubescence mostly ferruginous.

Of essentially the same range but forming individual and constant large colonies. The following, selected from thrice as many sheets, are characteristic. Nova Scotia (all distrib. as *A. incana*, var. *hypochlora*): Lahave R., Bridgewater, Lunenburg Co., *Fernald & Long*, no. 23,779; Wallace Lake, Italy Cross, Lun. Co., *F. & L.*, no. 23,780; Sloane L., Pleasant Valley, Yarmouth Co., *Fernald, Bissell, Graves, Long & Linder*, no. 21,015. Maine: Fairfield, Somerset Co., *Fernald & Long*, no. 13,472; Pembroke, Washington Co., *Fernald*, no. 1700; Burnham, Waldo Co., July 24, 1940, *Knowlton;* Nequasset L., Woolwich, Sagadahoc Co., *Fernald & Long*, no. 13,477; Cape Elizabeth, Cumberland Co., *Chamberlain*, no. 682; Limington, York Co., *Fernald & Long*, nos. 13,475, 13,479 and 13,480; Alfred, York Co., *F. & L.*, no. 13,478; Wells, York Co., *F. & L.*, no. 13,467; York Harbor, York Co., Aug., 1892, *Bicknell* (with unpublished new specific name). New Hampshire: Haverhill, Grafton Co., *Fernald*, no. 15,525; Mason, Hillsborough Co., Aug. 20, 1917, *C. F. Batchelder;* Dover, Strafford Co., *Hodgdon*, no. 2567; Hampton Falls, Rockingham Co., Sept. 10, 1916, *C. F. Batchelder;* Derry, Rock. Co., Aug. 15, 1926, *Batchelder;* Hinsdale, Cheshire Co., Aug. 23, 1919, *Batchelder.* Vermont: Milton, Chittenden Co., July 25, 1927, *Knowlton;* Hartford, Windsor Co., June 12, 1920, *Eaton & St. John;* Wallingford, Rutland Co., May 30, 1907, *Kennedy.* Massachusetts: Lynnfield, Essex Co., *Fernald & Bartlett*, no. 786; Round Pond, Tewksbury, Middlesex Co., April 14 and Oct. 14, 1906, *M. L. Fernald & H. H. Bartlett*, nos. 14 (type in Herb. Gray.) and 18; Fresh Pond, Cambridge, Mid. Co., 1842 or 43, *Asa Gray* (sheet sent to and identified by Regel as "*Alnus serrulata* Willd., β. *rugosa*"); West Cambridge, *Fernald & Bartlett*, no. 4; West Roxbury, Suffolk Co., March 25, April 5 and May 28, 1904, *F. F. Forbes;* Brookline, Norfolk Co., Oct. 11, 1914, *F. F. Forbes;* Milton, Norf. Co., March 26 and May 26, 1921, *Kidder;* Hanson, Plymouth Co., Aug. 30, 1941, *Knowlton;* Gunning P., Falmouth, Barnstable Co., *Fernald*, no. 578; Dennis P., Yarmouth, Sept. 19, 1913, *Fernald & Long*, as *A. noveboracensis;* Lambert Cove, Martha's Vineyard, Dukes Co., *Bicknell*, no. 3432; Great P., Martha's Vineyard, *Bicknell*, no. 3143 (as *A. noveboracensis*); Nantucket, *Bicknell*, no. 3438; Leominster, Worcester Co., *Fernald & Bean*, no. 14,017; Princeton, Wor. Co., July 22, 1913, *Weatherby;* Barre, Wor. Co., May 14, 1915, *Hunnewell, Macbride & Torrey;* Northfield, Franklin Co., May 11, 1912, *Fernald & Floyd;* Longmeadow, Hampden Co., May 18, 1913, *Hill & St. John;* Chester, Hampd. Co., May 17, 1913, *Weatherby & Bean;* Worthington, Hampshire Co., *B. L. Robinson*, no. 812; Adams, Berkshire Co., *Knowlton & Bean*, no. 15,107. Rhode Island: Newport, N. Co., *Mearns*, no. 603. Connecticut: Woodstock, Windham Co., July 31, 1919, *Weatherby;*

Pomfret, Wind. Co., July 4, 1901, *Driggs;* Franklin, New London Co., Aug. 27 and Nov. 21, 1912, *Woodward;* Sprague, N. L. Co., Sept. 3, 1913, *Woodward;* Tyler P., Goshen, Litchfield Co., *Weatherby*, no. 3350. New York: Bear P., French Mt., Warren Co., June 9, 1920, *Burnham;* Long L., Hamilton Co., *House*, no. 10,172; Mud Pond, Oswego, O. Co., *Fernald, Wiegand & Eames*, no. 14,246. Michigan: Douglas L., Cheboygan Co., *Ehlers*, no. 534. Indiana: Tremont, Porter Co., Sept. 9, 1920, *D. C. Peattie.*

The extreme with soft-pubescent lower leaf-surfaces, *Alnus rugosa*, forma *Emersoniana*, is named for that remarkably accurate and unexcelled student of Massachusetts trees and shrubs, George Barrell Emerson (1797–1881), author of the scholarly Report on the Trees and Shrubs in Massachusetts (2 vols., 1875), a famous and greatly honored educator, an intimate of Jacob Bigelow, adviser of Horace Mann, and one of the three trustees of the Arnold bequest which, as a result of his guidance, became the initial fund of the Arnold Arboretum. Emerson clearly understood and first discriminatingly stated the strong specific differences which separate the northern *Alnus rugosa* and the southern *A. serrulata.* These he accurately illustrated but, like every one of his period and up to the present, he did not get away from the conviction that our dark-barked shrub is identical with the whitish-barked tree of Europe. Although in Trees and Shrubs in Mass. i. 248 he definitely wrote "White Alder of Europe is a very beautiful tree, sometimes rising to the height of seventy feet", on p. 251 he began his very accurate account of "The Speckled Alder. *A. incana*, Willdenow", "easily distinguished by the brilliant, polished, reddish green color of its stem-bark", "speckled with conspicuous light gray dots", "The stem is usually eight or ten feet high and from one to three inches in diameter".

Emerson distinguished three variations of the Speckled Alder: (1) what he considered typical, with "leaves . . . broad oval, rounded or somewhat cordate at base . . . , doubly serrate or denticulate-serrate . . . smooth and conspicuously impressed at the veins and veinlets above; of a soft coriaceous texture; covered with abundant, soft, often ferruginous pubescence beneath, with the veins and veinlets strikingly prominent" (*A. rugosa*, forma *Emersoniana*); (2) *A. glauca* Michx.:

"A striking and very beautiful variety of the speckled alder, called the glaucous alder by the younger Michaux, is distinguished by the pale blue or glaucous color of the lower surface of the leaves. The pubescence is less abundant, but the veins and footstalk are often, as in the common form [i. e. *A. rugosa*, forma *Emersoniana*] of the tree, of a rusty color"; and (3) a series which Emerson considered "intermediate between the common [*A. serrulata*] and the glaucous alder . . . It differs from the common alder in its leaves being always acute and never obovate, and from the speckled, in having its leaves shining and free from down . . . The general aspect of this alder is similar to that of the speckled alder, differing in the greenness of the under surface of the leaves". Emerson's third variety was, apparently, a mixture of typical *A. rugosa* and the extreme of *A. serrulata* with subelliptic and round-based leaves.

Var. **americana** (Regel), comb. nov. *A. incana*, β. *americana* Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 155—repr. as Mon. Bet. 97 (1861); H. Winkl. in Engler, Pflanzenr. iv[61]. 123 (1904). *A. glauca* Michx. f. Hist. Arb. Forest. Am. Sept. iii. 320, t. 4, fig. 2 (1813). *A. incana*, var. *glauca* (Michx. f.) Loudon, Arbor. Brit. iii. 1688 (1838) pro parte, excl. citation of Ait.; Gray, Man. ed. 2: 412 (1856); Callier in Mitteil. Deutsche Dendr. Gesellsch. 1918: 143 (1918)[1], not Ait. Hort. Kew. ed. 2, v. 259 (1813). *A. incana*, α. *vulgaris* Spach in Ann. Sci. Nat. sér. 2, xi. 206 (1841) in small part only (*A. glauca* Michx. fil), excluding the synonyms "*Alnus incana* auctor", "*Alnus undulata* Pursh" (Pursh correctly giving *A. undulata* Willd. as a synonym of *A. crispa* Ait.) and "Foliis . . obovatis". *A. incana* sensu Tuckerm. in Am. Journ. Sci. xlv. 32 (1843) and most later Am. auth., not (L.) Moench. *A. americana* (Regel) Hort. ex K. Koch, Dendrol. ii[1]. 636 (1872).—Generally more northern in range, Labrador to Hudson Bay region and Saskatchewan, south to Newfoundland, Nova Scotia, Maine, New Hampshire, Massachusetts, uplands of Pennsylvania, Maryland and West Virginia, northern Ohio, northern Indiana, Wisconsin and northeastern Iowa. The following, selected from nearly 200 sheets before me, are characteristic. Labrador: Paradise R., Sandwich Bay (lat. 53° 30′, long. 57° 15′), *Harlow Bishop*, no. 275. Newfoundland: Clarenville, July 30, 1938, *Agnes M. Ayre;* Quarry, *Fernald &*

[1] Callier showed the usual Germanic lack of understanding of American geography, citing one specimen from "Dakota: New Anglia leg. Blake" and Mrs. Chase's no. 2105 from Dune Park, Indiana, as from "Michigan: Lake Michigan, Done Park". On a preceding page the strictly northeastern *A. rugosa* was cited from anywhere, including California.

Wiegand, no. 5302; Grand Falls, *F. & W.*, no. 5301; near mouth of Badger Brook, *Robinson & Schrenk*, no. 35; Little Red Indian Lake, *F. & W.*, no. 5300; Goose P., *F. & W.*, no. 3276; Winterhouse Brook, Bonne Bay, *Fernald, Long & Fogg*, no. 1647; Summerside, Bay of Islands, *F. & W.*, no. 3277; Table Mt., Port-à-Port Bay, *Fernald & St. John*, no. 10,828. QUEBEC: Natashquan R., Saguenay Co., July, Aug., 1912, *C. W. Townsend;* Piashtibaie, Sag. Co., *St. John*, no. 90,395; Seven Islands, Sag. Co., *C. B. Robinson*, no. 900; Douglastown, Gaspé Co., Aug. 22, 1904, *Collins, Fernald & Pease;* R. Ste. Anne des Monts, Gaspé Co., *Fernald & Collins*, no. 217; Bonaventure R., Bonav. Co., Aug. 4–8, 1904, *C. F. & P.;* Matane, M. Co., Aug. 5, 1904, *F. F. Forbes;* Bic, Rimouski Co., *Rousseau*, no. 21,457; Cap-à-l'Aigle, Charlevoix Co., *J. Macoun*, no. 68,768; Lac Tremblant, Terrebonne Co., July 23, 1922, *Churchill;* Black Lake, Megantic Co., *Fernald & Jackson*, no. 12,076; Georgeville, Stanstead Co., Aug. 22, 1914, *Churchill;* East Main, E. Coast of James Bay, *D. Potter*, no. 265; Rupert House, E. Coast, *Potter*, no. 260. MAGDALEN ISLANDS: Brion Island, *St. John*, no. 1847; Ile de l'Étang-du-Nord, *Victorin & Rolland*, no. 9418; Grindstone I., *Fernald, Bartram, Long & St. John*, no. 7310. NEW BRUNSWICK: Kent Co., 1870, *Fowler*. NOVA SCOTIA: Pottle's L., North Sydney, Cape Breton Co., *Bissell & Linder*, no. 21,020; Glenbard, near James River Sta., Antigonish Co., *Perry, Wetmore, Hicks & Prince*, no. 10,256; Musquodoboit Harbor, Halifax Co., *Rousseau*, no. 35,263; Deception L., Shelburne Co., *Fernald & Long*, no. 23,777; Clyde River, Shelb. Co., *J. G. Jack*, no. 3454; Butler's L., Gavelton, Yarmouth Co., *Fernald, Long & Linder*, no. 21,021; Lake Annis, Yarm. Co., *Bissell, Pease & Linder*, no. 21,017; Journeay L., Weymouth, Digby Co., *Fernald & Long*, no. 23,778. MAINE: Fort Kent, Aroostook Co., *Fernald*, no. 2446; Masardis, Aroost. Co., *Fernald*, no. 2447; Orono, Penobscot Co., May 30, 1904, *Fernald;* Foxcroft, Piscataquis Co., Aug. 31, 1897, *Fernald;* St. John P., Township iv, Range 17, Somerset Co., *St. John & Nichols*, no. 2272; Dead River, Som. Co., *Fernald & Strong*, no. 409, in part; Chesterville, Franklin Co., Aug. 28, 1904, *E. B. Chamberlain;* Calais, Washington Co., Aug. 24, 1928, *Knowlton;* Roque Bluff, Wash. Co., July 31, 1918, *Knowlton;* Northfield, Wash. Co., Aug. 2, 1941, *Knowlton;* Nicatous L., Twp. 3, Hancock Co., *Fassett*, no. 2378; Seal Harbor, Hanc. Co., July 8, 1889, *Redfield;* Brooklin, Hanc. Co., *A. F. Hill*, no. 1051; Isle au Haut, Knox Co., Aug. 26, 1927, *Kidder;* Monhegan I., Lincoln Co., Aug., 1911, *Kate Furbish;* Brunswick, Cumberland Co., Aug. 26, 1910, *Kate Furbish;* Baldwin, Cumb. Co., *Fernald & Long*, no. 13,470; North Berwick, York Co., Aug. 31, 1894, *Parlin*. NEW HAMPSHIRE: White Mountains, Tuckerman, labeled, "*Alnus incana*, Willd. *A. glauca*, Michx. f. species unica", with reference

to Tuckerman's treatment in Am. Jour. Sci. xlv. 32 (1845), this sheet marked by Regel *A. incana* β. *glauca;* Lake Umbagog, Cambridge, Coös Co., *Pease,* no. 18,150; Pittsburg, Coos Co., *Pease,* no. 10,297; summit of Cape Horn, Northumberland Co., Coös Co., *Pease,* no. 16,451; Jackson, Carroll Co., Aug. 1895, *E. W. Hervey;* Bow, Merrimack Co., Sept. 21, 1930, *G. M. Bryant;* Hillsborough, H. Co., Sept. 2, 1921, *C. F. Batchelder;* New Hampton, Belknap Co., Sept. 5, 1904, *F. F. Forbes;* Richmond, Cheshire Co., Aug. 21, 1919, *C. F. Batchelder;* Cheshire Co., *Robinson,* no. 156. Vermont: Brunswick Springs, Essex Co., *S. N. F. Sanford,* no. 1083; Willoughby, Orleans Co., July, 1898, *Kennedy:* Worcester, Washington Co., Aug. 25, 1875, *Blanchard;* Charlotte, Chittenden Co., April 15 and Sept. 29, 1879, *Pringle;* Hartland, Windsor Co., *J. G. Underwood,* no. 3116. Massachusetts: Lexington, Middlesex Co., March 23 and May 20, 1931, *L. B. Smith;* Buckland, Franklin Co., April 11 and Aug. 19, 1904, *F. F. Forbes;* Worthington, Hampshire Co., *B. L. Robinson,* no. 507; Pittsfield, Berkshire Co., Aug. 5, 1915, *Churchill.* New York: Norfolk, St. Lawrence Co., *Phelps,* nos. 1139–1141; Selkirk, Oswego Co., *Fernald, Wiegand & Eames,* no. 14,245; Canadice, Ontario Co., *C. C. Thomas,* no. 3926; Penn Yan, Gates Co., *Sartwell* (Sartwell Herb., Hamilton College, presumable duplicate of the type of *A. incana* β. *americana* Regel); western New York, *Asa Gray,* identified by Regel as *A. incana,* var. *glauca.* Pennsylvania: Little Mud P., e. of Porter's L., Pike Co., *Fogg,* no. 10,767; Pocono Plateau, Monroe Co., July, Aug., 1904, *Harshberger.* Maryland: s. of Finzel, Garrett Co., Aug. 15, 1936, *Wherry.* West Virginia: at 2500 ft. alt., e. of Gormannia, Grant Co., *Svenson,* no. 4439. Ontario: Lake Rosseau, Muskoka Co., *W. F. Wright,* no. 140; Moose River, James Bay, Nipissing Distr., *David Potter,* nos. 262–264; Sand Point, Algoma Distr., *Taylor et al.* no. 842; Batchawana R., Alg. Distr., *Taylor et al.* no. 839; Nipigon, Thunder Bay Distr., *Jennings & Daily,* no. 481. Michigan: Baraga, B. Co., *Fernald & Pease,* no. 3081. Ohio: Hiram, Portage Co., *R. J. Webb,* no. 1377. Indiana: Chesterton, Porter Co., Aug. 12, 1925, *Churchill.* Wisconsin: Kewaunee, K. Co., Aug. 2, 1902, *Schuette;* Brodhead, Green Co., *Fassett,* no. 12,931; Dayton, Green Co., *Fassett,* no. 13,990; Brown Co., 1880, *Schuette.* Minnesota: Sect. Nw.-Sw. 35, T. 144, R. 36, Clearwater Co., *M. L. Grant,* no. 3368; Cass L., Cass Co., *Pammel,* no. 5; Centre City, Chisago Co., July, 1892, *B. C. Taylor;* Bembridge, *Pammel,* no. 892. Iowa: Postville, Allamakee Co., June, 1914, *Schultz, Pammel & Orr;* Bluffton, Winneshiek Co., March 28 and Sept. 16, 1903, *Shimek;* New Hampton, Chickasaw Co., *Pammel,* no. 475. Plates 980 and 981.

Var. AMERICANA, forma **tomophylla** (Fernald), comb. nov. *A. incana*, var. *glauca*, f. *tomophylla* Fernald in RHODORA, xvi. 56 (1914). *A. incana*, var. *tomophylla* (erroneously attributed to Fernald) by Rehder, Man. Cult. Trees and Shrubs, 147 (1927).—Local. NEWFOUNDLAND: Norris Arm, *Fernald & Wiegand*, no. 5303 (TYPE). MAINE: Hartford, Oxford Co., Aug., 1892, *Parlin*. PLATE 982, FIG. 4.

Var. AMERICANA, forma **hypomalaca,** f. nov. (TAB. 982, FIG. 1–3), foliis subtus molliter persistenterque piloso-tomentulosis, pilis cinereis.—Local, often abundant, through much of the area of var. *americana*. QUEBEC: Pointe du Lac, St. Maurice Co., Aug. 2, 1923, *Chamberlain & Knowlton*. NEW BRUNSWICK: Shediac Cape, Westmoreland Co., July 3, 1914, *F. T. Hubbard;* Seal Cove Brook, Grand Manan, Charlotte Co., July 24, 1941, *C. A. & Una F. Weatherby*, no. 7015 (TYPE in Herb. Gray.). PRINCE EDWARD ISLAND: St. Charles, Kings Co., *Fernald & St. John*, no. 11,030. NOVA SCOTIA: Central Port Mouton, *Fernald, Bissell, Graves, Long & Linder*, no. 21,019; Meteghan, Digby Co., *Fernald & Long*, no. 21,016; Middleton, Annapolis Co., *Fernald, Pease & Long*, no. 21,018. MAINE: Houlton, Aroostook Co., Aug. 26, 1897, *Fernald;* Patten, Penobscot Co., Aug. 23, 1897, *Fernald;* Milford, *Fernald & Long*, nos. 13,468 and 13,469; Fryeburg, Oxford Co., *C. E. Faxon;* Cutler, Washington Co., July 1, 1902, *Kennedy et al.;* Pembroke, Wash. Co., *Fernald*, no. 1699; Dedham, Hancock Co., *Fernald & Long*, no. 13,465; Deer Isle, Hanc. Co., *A. F. Hill*, no. 2096; Atlantic, Swans Island, Hanc. Co., *Hill*, no. 2281; Rockport, Knox Co., *Rossbach*, no. 1207; Nequasset L., Woolwich, Sagadahoc Co., *Fernald & Long*, no. 13,477; Leeds, Androscoggin Co., July 23, 1913, *Knowlton;* Falmouth, Cumberland Co., *Chamberlain & Bissell*, no. 389; Limington, York Co., *Fernald & Long*, nos. 13,479 and 13,480; Alfred, York Co., *F. & L.*, no. 13,466; Kennebunkport, York Co., Aug. 1929, *C. A. Cheever*. NEW HAMPSHIRE: Mt. Washington, Coös Co., July 16, 1891, *Kennedy:* Randolph, Coös Co., *Pease*, no. 11,179; Shelburne, Coös Co., *Pease*, no. 11,133; Jackson, Carroll Co., July 12, 1883, *C. W. Jenks;* Warren, Grafton Co., July 24, 1908, *E. F. Williams;* Merrimack, Hillsborough Co., Aug. 11, 1917, *C. F. Batchelder;* Rindge, Cheshire Co., May 30, 1912, *F. F. Forbes*. VERMONT: Stowe, Lamoille Co., July 27, 1884, *C. W. Swan*. MASSACHUSETTS: Round Pond, Tewksbury, Middlesex Co., *Fernald & Bartlett*, no. 15; Beaver Brook Reservation, Mid. Co., May 26, 1894, *G. L. Chandler;* Brookline, Norfolk Co., Sept. 25, 1905, *F. F. Forbes;* Needham, Norf. Co., *T. O. Fuller;* Springfield, Hampden Co., June 17, 1913, *Luman Andrews;* Cheshire, Berkshire Co., July, 1912, *E. J. Winslow;* Sheffield, Berks. Co., July 24, 1912, *Hoffmann*. NEW YORK: Axton, Franklin Co., July 10,

1899, *Rowlee, Wiegand & Hastings;* Conklingville, Saratoga Co., *Fogg,* no. 15,161. Ontario: Kokoko Bay, Timagami Region, *Edgar & Dorothy M. Anderson,* no. 26,045B; Stokes Bay, Bruce Peninsula, *Krotkov,* no. 8948. Indiana: Dune Park, Porter Co., *Greenman,* no. 2683.

Alnus rugosa, vars. *typica* and *americana* are not mere forms, the former with green to rufescent lower leaf-surfaces, the latter with them glaucous, gray or cinereous. The latter is decidedly more northern in range. I am indebted to Professor Rehder and Dr. A. C. Smith for the use of a Sartwell sheet from Penn-Yan, New York, lent by the Herbarium of Hamilton College. This is presumably part of the original collection upon which Regel founded his *A. incana,* β. *americana.* The approximately 400 sheets showing foliage in the Gray Herbarium and the herbarium of the New England Botanical Club, when tabulated, give the following proportions (in percentages).

Labrador Peninsula, var. *typica* 0, var. *amer.* 100%; Newfoundland, var. *typica* 0, var. *amer.* 100; Quebec (south of Lab. Pen.), var. *typica* 0, var. *amer.* 100; New Brunswick, var. *typica* 0, var. *amer.* 100; Nova Scotia, var. *typica* 43, var. *amer.* 57; Northern Maine (northern tier of counties), var. *typica* 59, var. *amer.* 41; Southern Maine, var. *typica* 80, var. *amer.* 20; Coös Co., New Hampshire, var. *typica* 5, var. *amer.* 95; rest of New Hampshire, var. *typica* 65, var. *amer.* 35; Vermont, var. *typica,* 62, var. *amer.* 38; Massachusetts, var. *typica* 89, var. *amer.* 11; Rhode Island, var. *typica* 100, var. *amer.* 0; Connecticut, var. *typica* 100, var. *amer.* 0.

The variations which I treat as forms show no such geographic concentrations; they are scattered throughout the range of the variety under which they are placed.

2. A. serrulata (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805).—The following varieties and forms are recognized.

a. Principal leaves definitely obovate, cuneate, or subcuneate to subacute at base; those of vigorous 1st. year's shoots obtuse or acute; those of fertile branches of 2nd. year one third to two thirds as broad as long.
Lower surfaces of mature leaves glabrous or strongly glabrescent.....Var. *vulgaris.*
Lower surfaces of mature leaves permanently and densely pilose-tomentulose, plush-like to touch.....Forma *noveboracensis.*
a. Principal leaves broadly elliptic-obovate to broadly oblong-elliptic or subrotund (though broadest at or above the middle), gradually rounded at base; those of fertile branches of 2nd. year mostly three fifths to nine tenths as broad as long....*b.*
b. Lower surfaces of mature leaves glabrous or strongly glabrescent.

Leaves gradually rounded to subacute (or more rarely acute) at apex, mostly 6–15 cm. long; staminate aments 3–7 cm. long.....Var. *subelliptica.*
Leaves broadly retuse or emarginate at apex, mostly 2–5 cm. long; staminate aments 2 cm. long.....Forma *emarginata.*

b. Lower surfaces of mature leaves permanently and densely pilose-tomentulose, plush-like to touch.
Large shrub or small tree; principal leaves 6–12 cm. long; mature cones 1–2 cm. long; staminate aments 3–7 cm. long.....Forma *mollescens.*
Dwarf shrub 0.5–1 m. high; principal leaves 2–5 cm. long; mature cones 6–12 mm. long; staminate aments 1.3–1.8 cm. long.....Forma *nanella.*

A. SERRULATA, var. VULGARIS Spach in Ann. Sci. Nat. sér. 2, Bot. xv. 206 (1841), in part ("Foliis . . . lanceolato-obovatis, v. obovatis, v. oblongo-obovatis, saepius obtusis v. vix acuminatis, basi cuneatis"). *Betula-Alnus rubra* Marsh. Arb. Am. 20 (1785), presumably. *Betula serrulata* Ait. Hort. Kew. iii. 338 (1789); Willd. Berlin. Baumzucht, 45 (1796), at least as to citation of Ait. *A. serrulata* (Ait.) Willd. Sp. Pl. iv[1]. 336 (1805). *A. rubra* (Marsh.) Tuckerm. in Am. Journ. Sci. xlv. 32 (1843), not Bong. (1833). *A. glutinosa,* δ. *serrulata* (Ait.) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 164, t. xi. fig. 7—repr. as Mon. Bet. 106, t. xi. fig. 7 (1861), in part, incl. basonym. *A. glutinosa,* δ. *serrulata,* lusus a. *genuina* Regel, l. c. fig. 6 (1861). *A. glutinosa,* δ. *serrulata,* lusus b. *obtusifolia* Regel, l. c. fig. 7 (1861). *A. serrulata,* α. *genuina* Regel in DC. Prodr. xvi[2]. 188 (1868), in part. *A. serrulata,* δ. *obtusifolia* Regel, l. c. (1868). *A. rugosa* sensu K. Koch, Dendrol. ii. 635 (1872); sensu Coulter in Mem. Torr. Bot. Cl. v. 131 (1894); sensu Sargent, Silva, ix. 69 (1896) and subseq. auth.; not Spreng. (1825). *A. rugosa,* var. *serrulata* (Ait.) H. Winkler in Engler, Pflanzenr. iv[61]. 120 (1904). *A. rugosa,* var. *obtusifolia* (Regel) H. Winkler, l. c. (1904). *A. serrulata pumila* Dameker in Mitt. Deutsch. Dendr. Ges. 1909: 326 (1909).—Northern Florida to Louisiana, north to southwestern Nova Scotia, central and southern Maine, southern New Hampshire, central Vermont, New York, West Virginia, Ohio, Indiana, Illinois, Missouri and southeastern Oklahoma. The following, selected from many hundreds of sheets, are characteristic. NOVA SCOTIA: Ponhook L., Queen's Co., *Weatherby,* no. 6955: Cameron L., South Brookfield, Queen's Co., *C. A. & Una F. Weatherby,* no. 7059. MAINE: North P., Norway, Oxford Co., *Pease,* no. 24,100; near Jordan P., Mt. Desert I., Hancock Co., *Stebbins,* no. 235; Bristol, Lincoln Co., *E. B. Chamberlain,* no. 716; South Poland, Androscoggin Co., 1893, *Kate Furbish;* Wilson's Mill, Cumberland, C. Co., *Chamberlain, Morris & Ricker,* no. 852; Limington, York Co., *Fernald & Long,* no. 13,481; Cape Neddick, York Co., *J. G. Jack,* no. 3394. NEW HAMPSHIRE: Wild Goose P., Strafford, S. Co., *Hodgdon & Cham-*

berlain, no. 2886; Nottingham, Rockingham Co., *A. A. Eaton*, no. 435; Danville, Rock. Co., *Pease*, no. 28,210; Manchester, Hillsborough Co., Oct. 2, 1896, *F. W. Batchelder;* Walpole, Cheshire Co., *Fernald*, no. 505; Sandy P., Richmond, Chesh. Co., Sept. 3, 1916, *C. F. Batchelder*. VERMONT: L. St. Catherine, Wells, Rutland Co., *Dodge & Fassett*, no. 822. MASSACHUSETTS: Andover, Essex Co., *Pease*, no. 3432; Ashby, Middlesex Co., May 30, 1914, *Knowlton;* Concord, Mid. Co., April 4 and July 20, 1858, *E. S. Hoar;* Wilmington, Mid. Co., *Fernald & Bartlett*, no. 9; West Roxbury, Suffolk Co., Aug. 9 and Sept. 9, 1904, *F. F. Forbes;* Blue Hills Reserv., Aug. 11, 1895, *E. F. Williams;* Lakeville, Plymouth Co., *Fernald & Long*, no. 9345; Prospect Hill P., Taunton, Bristol Co., *F. C. Seymour*, no. 4460; Brewster, Barnstable Co., *Fernald*, no. 16,684; Provincetown, Barns. Co., *Fernald & Long*, no. 18,356; Chilmark, Martha's Vineyard, Dukes Co., *F. C. Seymour*, no. 1671; Harvard, Worcester Co., Aug. 6, 1916 and April 22, 1917, *F. F. Forbes;* Gill, Franklin Co., May 11, 1912, *St. John & Weatherby;* Ware, Hamshire Co., *Goodale, Potsubay & St. John*, no. 64,660; Stockbridge, Berkshire Co., Aug. 6, 1917, *Hoffmann*. RHODE ISLAND: Lincoln, Providence Co., *St. John*, no. 894: Barrington, Bristol Co., May 20, 1911, *E. J. Winslow;* Warren, Bristol Co., July 25, 1919, *Sanford;* Prudence I., Newport Co., *Sanford*, no. 10,377; Richmond, Washington Co., Aug. 30, 1919, *Fernald & Collins;* Hopkinton, Wash. Co., Sept. 1, 1919, *Fernald, Woodward & Collins*. CONNECTICUT: Woodstock, Windham Co., *Weatherby*, no. 4519; Franklin, New London Co., Oct. 4, 1913, *Woodward;* Tolland, T. Co., *Weatherby*, no. 5330; Tariffville, Hartford Co., May 17, 1913, *Winslow & Hill;* North Guilford, New Haven Co., July 11, 1904, *W. R. Dudley*. NEW YORK: West Fort Ann, Washington Co., Aug. 17, 1913, *Dobbin & Burnham;* Ballston L., Saratoga Co., Aug. 11, 1906, *Burnham;* Sutherland P., Black Lake Forest, Orange Co., *Raup*, no. 7746; Fishers Island, Suffolk Co., *St. John*, no. 2683; Sandy Creek Township, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,248; Ithaca, Tompkins Co., *MacDaniels*, no. 3928. NEW JERSEY: Oradell, Bergen Co., April 16 and Oct. 8, 1905, *Mackenzie;* Denville, Morris Co., Aug. 13, 1905, *Mackenzie;* Vincetown, Burlington Co., *Long*, no. 11,091; Pleasantville, Atlantic Co., *Tidestrom*, no. 11,377; Friendship, Salem Co., *Long*, no. 51,606. PENNSYLVANIA: Scotrun, Monroe Co., Aug., 1906, *B. Long;* Chester Co., *Sharpless*, no. 276; Smithfield Swamp, Lancaster Co., Aug. 30, 1889, *Heller;* Mifflinville, Columbia Co., *Fogg*, no. 14,537; Farrandsville, Clinton Co., *Fogg*, no. 11,516; Fayette Co., *Dickey*, nos. 21 and 205. DELAWARE: Cool Spring, Sussex Co., *Larsen*, no. 459. MARYLAND: Chesapeake City, Cecil Co., *Tidestrom*, no. 11,679; St. Mary's Co., *Tidestrom*, no. 5062. DISTRICT OF COLUMBIA: Brookland, Oct. 15, 1898,

Holm; Terra Cotta, Aug. 18, 1915, *Holm.* West Virginia: Huttonsville, Randolph Co., *Greenman,* no. 330; Tygart Junction, Barbour Co., *Greenman,* no. 329; between Gilmer and Read, Gilmer Co., *Greenman,* no. 331. Virginia: se. of Alexandria, Fairfax Co., *Wiegand & Manning,* no. 958; ne. of Mechanicsville, Louisa Co., *Adams & Wherry,* no. 2228; Capital Landing Creek, York Co., *Mentzel,* no. 145; Oceana, Princess Anne Co., *Fernald & Long,* nos. 3896 and 3897; eastern shore, Lake Drummond, Norfolk Co., *J. Arthur Harris,* no. C 18,233; Zuni, Isle of Wight Co., *Fernald, Griscom & Long,* no. 6582; south of South Quay, Nansemond Co., *F. & L.,* no. 11,559; south of Franklin, Southampton Co., *F. & L.,* no. 8235; e. of Dan River, Halifax Co., *Fosburg,* no. 15,383; Hollins School, Roanoke Co., *C. E. Wood, Jr.,* no. 5483; "Mts., Virg. 1843", *Asa Gray* (type of var. *obtusifolia* Regel, in Gray Herb.); Bane, Giles Co., *Fogg,* no. 14,714, as *A. crispa;* Peak Creek, Pulaski Co., at 2200 ft. alt., July 16, 1892, *Small.* North Carolina: Snow Hill, Greene Co., *L. F. & F. R. Randolph,* no. 776; Clinton, Sampson Co., *Godfrey,* no. 5895; Biltmore, Buncombe Co., *Bilt. Herb.* no. 1240[b]; at 4000 ft. alt., Pisgah Forest, Transylvania Co., *House,* no. 4041; at 1700 ft. alt., Great Smoky Mts., Swain Co., July, 1891, *Beardslee & Kofoid.* South Carolina: s. of Myrtle Beach, Horry Co., *Weatherby & Griscom,* no. 16,511; Georgetown, G. Co., *Godfrey & Tryon,* no. 988; Santee Canal, *Ravenel* (identified by Regel as his var. *genuina*); Summerville, Dorchester Co., *B. L. Robinson,* no. 114; se. of Elloree, Orangeburg Co., *Godfrey & Tryon,* no. 1503. Georgia: se. of Ludowici, Long Co., *Wiegand & Manning,* no. 962; s. of Cuthbert, Randolph Co., *Harper,* no. 1782. Florida: River Junction, Gadsden Co., *Nash,* no. 2590; Peters Creek, Clay Co., *Small & DeWinkeler,* no. 9706. Indiana: s. of Chestnut Ridge, Jackson Co., *Deam,* no. 13,740. Kentucky: Keyser Creek, Boyd Co., Sept. 25, 1937, *T. N. McCoy;* Tygart's Creek, Carter Co., Oct. 16, 1937, *E. L. Braun;* "Fernbank—ad ripas fluminis Ohio, prope 'North Bend'", *Short.* Tennessee: Rugby, Morgan Co., *Svenson,* no. 4048; Sunbright, alt. 2200 ft., Morgan Co., *Svenson,* no. 4117; n. of Manchester, Coffee Co., *Svenson,* no. 9256; Hollow Rock Jc., Carroll Co., *Svenson,* no. 374. Alabama: n. of Headland, Henry Co., *Wiegand & Manning,* no. 964; Perdido, Baldwin Co., *Blanton,* no. 7087. Illinois: Pope Co., July 31, 1898, *G. P. Clinton.* Missouri: Jefferson Co., July, 1887, *Eggert;* Bismark, St. Francois Co., *E. J. Palmer,* no. 18,065; Monteer, Shannon Co., *Bush,* nos. 204 and 7852. Arkansas: Kensett, White Co., *Demaree,* no. 8658; Siloam Springs, Benton Co., *Demaree,* no. 4626; Washington Co., Aug. 17, 1895, *Blankinship;* Howard Co., *Demaree,* no. 9734; Murfreesboro, Pike Co., *Demaree,* no. 9377; Locksburg, Sevier Co., *Demaree,* no. 9890. Louisiana: New Orleans, 1832, *Drummond;* n. of Kisatchie, Natchitoches Parish,

D. S. & H. B. Correll, no. 9765. OKLAHOMA: Page, LeFlore Co., *Stevens*, no. 2619; Valliant, McCurtain Co., *Demaree*, no. 12,022 (appr. var. *subelliptica*). PLATES 983 and 984.

Var. VULGARIS, forma **noveboracensis** (Britton), stat. nov. *A. noveboracensis* Britton in Torreya, iv. 124 (1904) and N. Am. Trees, 264, fig. 224 (1908). *A. rugosa*, race? Britton in Britt. & Brown, Ill. Fl. ed. 2, i. 613 (1913).—Differing from typical var. *vulgaris* only in the persistent plush-like pubescence of the lower leaf-surfaces.—Scattered through the range, often abundant. MAINE: Orono, Penobscot Co., *Fernald & Long*, no. 13,473, as *A. incana*, var. *hypochlora*. MASSACHUSETTS: West Roxbury, April 5 and May 18, 1904, *F. F. Forbes*. RHODE ISLAND: Washington P., Kent Co., May 24, 1914, *Thos. Hope*. NEW YORK: Grant City, Staten I., Aug. 5, 1894, *Britton* (TYPE of *A. noveboracensis*); Selkirk, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,247. NEW JERSEY: South Amboy, Middlesex Co., *Mackenzie*, no. 1465. VIRGINIA: Blackwater R., Princess Anne Co., *Fernald & Long*, no. 3898; w. of Franklin, Southampton Co., *F. & L.*, no. 6583; se. of Branchville, South. Co., *F. & L.*, no. 10,231; n. of Skipper's, Greensville Co., *F. & L.*, no. 8693. SOUTH CAROLINA: *M. A. Curtis*. GEORGIA: s. of Athens, Clarke Co., *Duncan & Roland*, no. 3877; Augusta, Richmond Co., *Olney & Metcalf*, no. 91. KENTUCKY: Harlan Court House, Harlan Co., *Kearney*, no. 7; s. of Albany, Clinton Co., *Smith & Hodgdon*, no. 3992. TENNESSEE: between Lexington and Natchez Trace Forest, Henderson Co., *Svenson*, no. 10,499. LOUISIANA: *Hale* (identified by Regel as his *A. serrulata*, var. *genuina*). PLATE 985.

Var. **subelliptica,** var. nov. (TAB. 986), foliis late elliptico-obovatis vel oblongo-ellipticis vel subrotundo-obovatis basin versus sensim rotundatis, subtus glabris vel glabratis; amentis masculis 3–7 cm. longis; strobilis maturis 1–2 cm. longis.—Georgia, north to southern New Hampshire, Massachusetts and New York. NEW HAMPSHIRE: Wheelwright P., Lee, Strafford Co., *Hodgdon*, no. 2576. MASSACHUSETTS: Rockport, Essex Co., *L. B. Smith & R. C. Gates*, nos. 964 and 965; Round P., Tewksbury, Middlesex Co., *Fernald & Bartlett*, no. 17; sandy swamp, Tewksbury, April 14 and October 14, 1906, *Fernald & Bartlett*, no. 16 (TYPE in Herb. Gray.); Winchester, Mid. Co., *F. & B.*, nos. 8, 11 and 13; West Cambridge, Mid. Co., *F. & B.*, no. 3; Fresh Pond, Cambridge, Sept. 29, 1894, *Robinson*, also *F. & B.*, no. 1; Bedford, Mid. Co., Sept. 12, 1903, *Knowlton;* Needham, Norfolk Co., April 20 and July 3, 1883, *T. O. Fuller;* Bellingham, Norf. Co., Sept. 17, 1935, *Ordway & Sanford;* Silver L., Kingston, Plymouth Co., Aug. 30, 1941, *Knowlton;* Wareham, Plym. Co., Sept. 18, 1925, *Knowlton;* Waquoit, Falmouth, Barnstable Co., *R. A. Ware*, no. 336; East Sandwich,

Barn. Co., Sept. 16, 1916, *F. F. Forbes;* Seward's P., West Barnstable, Barn. Co., *St. John & White,* no. 924; Great P., Centerville, Barn. Co., June 16, 1895, *E. F. Williams;* Walker P., Brewster, Barn. Co., *Fernald,* no. 16,681; Sheep P., Brewster, *Fernald,* no. 16,683; Cliff P., Brewster, *Fernald & Long,* no. 16,685; Davis P., Greenwich, Hampshire Co., *Pease,* no. 20,353. RHODE ISLAND: Limerock, Lincoln, Providence Co., Oct. 19, 1906, *J. F. Collins;* East Providence, Prov. Co., Oct. 17, 1906, *Collins;* Wash. P., Block Island, Newport Co., *Fernald, Hunnewell & Long,* no. 9344. CONNECTICUT: Coventry, Tolland Co., Aug., 1916, *Weatherby & Smith;* Ladd Fool Bridge, Franklin, New London Co., Aug. 24 and Sept. 6, 1912, *Woodward;* Rainbow, Windsor, Hartford Co., Sept. 20, 1908, *H. S. Clark;* Southington, Hartford Co., *L. Andrews,* no. 182; Oxford, New Haven Co., April 16, 1888 and July 30, 1899, *Harger.* NEW YORK: Long L., Hamilton Co., *House,* no. 13,513; Ashokan, Ulster Co., *Muenscher,* no. 16,104; Glycerine Hollow, Black Lake Forest, Orange Co., *Raup,* nos. 7789 and 7792; Peconic R., Southampton, Suffolk Co., *St. John,* no. 2682: Renwick Flats, Ithaca, Tompkins Co., *MacDaniels,* no. 3927. PENNSYLVANIA: near Kimbles, Pike Co., *Fogg,* no. 10,780; Allegheny Co., *Dickey,* no. 24. VIRGINIA: n. of Keyesville, Charlotte Co., *Fosberg,* no. 15,531; se. of Whitemarsh School, Nansemond Co., *Fernald & Long,* no. 11,558 (transitional); south of South Quay,Nans. Co., *F. & L.,* no. 10,611. NORTH CAROLINA: Parkville, Perquimans Co., *L. F. & F. R. Randolph,* no. 682; Raleigh, Wake Co., *Godfrey,* no. 4957; Hamlet, Richmond Co., *Wiegand & Manning,* no. 960. SOUTH CAROLINA: Pee Dee R. at Mars Bluff, Florence Co., *Wiegand & Manning,* no. 961. GEORGIA: e. se. of Statesboro, Bulloch Co., July 5, 1936, *Wherry.*

Var. SUBELLIPTICA forma **emarginata,** f. nov. (TAB. 987). Frutex ad 1.5 m. alta; foliis subrotundo-obovatis 2–5 cm. longis 1.5–4 cm. latis basin versus rotundatis apice late emarginatis paginis inferioribus glabratis; amentis masculis 2 cm. longis; strobilis maturis 5–10 mm. longis.—CONNECTICUT: open, rather sphagnous, swamp, Rainbow, Windsor, Hartford Co., Sept. 16, 1906 and April 6, 1907, *C. H. Bissell & C. A. Weatherby* (*Weatherby,* no. 2031), TYPE in Herb. Gray.

Var. SUBELLIPTICA, forma **mollescens,** f. nov. (TAB. 988). Frutex altus vel arbor fastigiata ad 8 m. alta; foliis ut in var. *subelliptica* 6–12 cm. longis apice obtusis vel acutis basin versus rotundatis subtus dense persistenterque subvelutinis; strobilis maturis 1–2 cm. longis.—Scattered through the range of the variety. NEW ENGLAND: old specimen from "Nova Anglia", *Oakes,* identified by Regel as his var. *genuina.* MASSACHUSETTS: Plum Island, Essex Co., *St. John,* no. 837; Winchester, Middlesex Co., July, 1907, *Knowlton;* Sharon, Norfolk Co., *S. F. Poole,*

no. 3; Barnstable, B. Co., *Fernald & Woodward*, nos. 15,124 and 15,126; Sheep P., Brewster, Barn. Co., *Fernald*, no. 16,682; Seth's P., West Tisbury, Dukes Co., *Fernald & Fogg*, no. 888; Brookfield, Worcester Co., *Hill, St. John & Torrey*, no. T. 261. CONNECTICUT: Thompson, Windham Co., June 11, 1922, *Eaton, Fassett, Jack, Linder & Peattie*. NEW YORK: wet hollow, Riverhead, Southampton, Suffolk Co., July 25–Aug. 3, 1920, *St. John*, no. 2681 (TYPE in Herb. Gray.). NEW JERSEY: South Amboy, Middlesex Co., *Mackenzie*, no. 1906. VIRGINIA: Little Neck, Princess Anne Co., *Fernald & Long*, no. 3899. NORTH CAROLINA: Raleigh, Wake Co., *Godfrey*, no. 4052; Gilson, Scotland Co., *Godfrey*, no. 5073.

Var. *subelliptica*, at the northern border of its range, has often been taken for a hybrid of *Alnus serrulata* (var. *vulgaris*) and *A. rugosa* (var. *typica*) and in outline of leaf it is suggestive of such an origin. It has, however, the characteristic bark, glutinous or gummy quality, branching of inflorescence and venation and serrulation of leaves of *A. serrulata*, not of *A. rugosa*. In southern New England and New York the two species meet, but farther south, from eastern Maryland to Georgia, no representative of the latter species is known.

Var. SUBELLIPTICA, forma **nanella,** f. nov. (TAB. 989), nana, 0.5–1 m. alta; foliis elliptico-obovatis 2–5 cm. longis, subtus subvelutinis; strobilis maturis 6–12 mm. longis.—VIRGINIA: dwarf shrubs with scattered simple stems only 5–8 mm. thick, springy sphagnous and argillaceous bog, Ram-hole Swamp, Seward Forest, near Triplett, Brunswick Co., June 22 and Sept. 13, 1944, *Fernald (and Lewis)*, no. 14,596 (TYPE in Herb. Gray.); with *Lachnocaulon anceps, Sarracenia flava*, etc., bushy sphagnous swamp southeast of Petersburg, at head of Poo Run, Prince George Co., *Fernald & Long*, no. 6167.

EXPLANATION OF PLATES

PLATE 976, ALNUS INCANA (L.) Moench.: FIG. 1, leading shoot, with foliage and young aments, × 1, from Breslau, Sept. 20, 1908, *Ziesché;* FIG. 2, lower surface of leaf, × 10, from Charlottenbrunn, Silesia, *Baenitz*, no. 1373; FIG. 3, inflorescence, × 1, from Möenlycke, April, 1890, *Walter Unlemann*, Fl. Scand.; FIG. 4, mature cones, from *Baenitz*, no. 1373; FIG. 5, half a cone, × 4, from Wurzburg, *Fl. exsicc. Bavar.*, no. 56; FIG. 6, bract, × 10, from Bohemia, July, 1887, *Fopitze;* FIG. 7, nutlet, × 10, from same specimen as fig. 6.

PLATES 977 and 978, A. RUGOSA (Du Roi) Spreng., var. TYPICA H. Winkl. PLATE 977: FIG. 1, fruiting branch, × 1, of shrub spread from cultivation in Europe, from Gehölze an der Lüneburger Eisenbahn nach Motrich, Wittenberge, *Baenitz, Herb. Dendrol.* no. 1214; fig. 2, venation of lower leaf-surface, × 10, from no. 1214; FIG. 3, half a cone, × 4, from no. 1214; FIG. 4, nutlet, × 10, frrom no. 1214. PLATE 978: FIG. 1, fruting branch from Narrows Island, Black Lake, New York, *Fernald, Wiegand & Eames*, no. 14,251; FIG. 2,

venation of lower leaf-surface, × 10, from no 14,251; FIG. 3, portion of cone, × 4, from no. 14,251; FIG. 4, achene, and FIG. 5, bract, × 10, from no. 14,251.

PLATE 979, FIGS. 1–3, A. RUGOSA, var. TYPICA: FIG. 1, terminal leaves of vegetative sprout, × ca. ½, from TOPOTYPE, Harbke Garten, *Ehrhart*, no. 88; FIG. 2, branches of strictly pistillate shrub, × 1, from Townshend, Vermont, June 2, 1912, *L. A. Wheeler;* FIG. 3, inflorescence, × 1, from West Roxbury, Massachusetts, April 9, 1906, *F. F. Forbes.* FIG. 4, forma EMERSONIANA Fernald: lower surface of leaf, × 10, from TYPE.

PLATES 980 and 981, A. RUGOSA, var. AMERICANA (Regel) Fernald. PLATE 980: FIG. 1, fruiting branch, × 1, from Douglastown, Gaspé Co., Quebec, Aug. 22, 1904, *Collins, Fernald & Pease;* FIG. 2, bark, × 1, from Rindge, New Hampshire, Sept. 8, 1917, *C. F. Batchelder;* FIG. 3, group of cones, × 4, from same specimen as fig. 1. PLATE 981: FIG. 1, foliage and young aments of larger-leaved specimen, × 1, from Hillsborough, New Hampshire, Sept. 3, 1921, *C. F. Batchelder;* FIG. 2, inflorescence, × 1, from Buckland, Massachusetts, April 11, 1904, *F. F. Forbes.*

PLATE 982, FIGS. 1–3, A. RUGOSA, var. AMERICANA, forma HYPOMALACA Fernald: FIG. 1, foliage, × 1, of TYPE; FIG. 2, foliage of vigorous sprout, × 1, from Tewksbury, Massachusetts, *Fernald & Bartlett*, no. 15; FIG. 3, lower surface of leaf, × 10, from TYPE. FIG. 4, var. AMERICANA, forma TOMOPHYLLA Fernald; leaf, × 1, from TYPE.

PLATES 983 and 984, A. SERRULATA (Ait.) Willd., var. VULGARIS Spach. PLATE 983, extreme with more acute leaves, "Foliis obovatis acutis", *Aiton:* FIG. 1, foliage of vigorous sprout-shoot, × 1, from Newton, Massachusetts, *Wm. Boott;* FIG. 2, foliage and incipient inflorescence of fertile branch, × 1, from Oceana, Virginia, *Fernald & Long*, no. 3896; FIG. 3, inflorescence, × 1, from Centerville, Massachusetts, April 18, 1897, *E. F. Williams;* FIG. 4, old cones, × 1, from Weymouth, New Jersey, *Long*, no. 25,358; FIG. 5, half a cone, × 4, from Stoneham, Massachusetts, April 16, 1896, *W. P. Rich;* FIG. 6, nutlet, × 10, from *Long*, no. 25,358. PLATE 984, extreme with obtuse leaves; FIG. 1, TYPE, × 1, of var. *obtusifolia* Regel; FIG. 2, narrower leaf (approaching forma *nanella*), × 1, from Richmond, Rhode Island, Aug. 20, 1919, *Fernald & Collins;* FIG. 3, broadest-leaved extreme, approaching var. *subelliptica*, × 1, from Wareham, Massachusetts, Sept. 18, 1928, *C. H. Knowlton;* FIG. 4, venation of lower leaf-surface, × 10, from same leaf as in fig. 2; FIG. 5, young inflorescences of staminate shrub, × 1, from south of South Quay, Virginia, *Fernald & Long*, no. 11,559.

PLATE 985, A. SERRULATA, var. VULGARIS, forma NOVEBORACENSIS (Britton) Fernald: FIG. 1, TYPE, × ½, of *A. noveboracensis* Britton; FIG. 2, tip with incipient inflorescence, × ½, from Selkirk, Oswego Co., New York, *Fernald, Wiegand & Eames*, no. 14,247; FIG. 3, fruiting cones, × 1, from no. 14,247; FIG. 4, lower surface of leaf, × 10, from no. 14,247; FIG. 5, bark, × 1, from Orono, Maine, *Fernald & Long*, no. 13,473.

PLATE 986, A. SERRULATA, var. SUBELLIPTICA Fernald, all figs. from TYPE: FIG. 1, foliage and incipient inflorescence, × 1; FIG. 2, inflorescence, × 1; FIG. 3, fruit, × 1; FIG. 4, bract, × 10; FIG. 5, nutlet, × 10.

PLATE 987, A. SERRULATA, var. SUBELLIPTICA, forma EMARGINATA Fernald, all figs. from TYPE: FIG. 1, fruiting branch, × 1; FIG. 2, largest leaves, × 1; FIG. 3, flowering tip, × 1; FIG. 4, lower surface of leaf, × 10.

PLATE 988, A. SERRULATA, var. SUBELLIPTICA, forma MOLLESCENS Fernald: FIG. 1, leaf and incipient inflorescence, × 1, from TYPE; FIG. 2, old cones, × 1, of TYPE; FIG. 3, lower surface of leaf, × 10, from TYPE; FIG. 4, branch with unusually long cones, × 1, from Little Neck, Virginia, *Fernald & Long*, no. 3899.

PLATE 989, A. SERRULATA, var. SUBELLIPTICA, forma NANELLA Fernald, all figs. from TYPE: FIGS. 1 and 2, fruiting branches, × 1; FIG. 3, lower surface of leaf, × 10; FIG. 4, nutlet, × 10.

A necessary Transfer in Populus § Turanga.—During the compilation of bibliography preliminary to monographic studies in the genus *Populus*, it has become evident that there is an earlier name for the British East African Poplar known as *Populus Denhardtiorum* (Engler) Dode, the said combination made in 1909.

Dode's basonym was *Populus euphratica* Olivier, subsp. *Denhardtiorum* Engler (1898). But Engler himself, in 1905 (Bot. Jahrb. **36:** 252. 1905), had clearly indicated that he had given a full description of the same tree under the name *Celtis ilicifolia* in his Pflanzenwelt Ost-Afrikas, Theil C, p. 160. 1895. It is, then, clear that this species should bear the following name:

Populus **ilicifolia** (Engler) comb. nov. *Celtis ilicifolia* Engler in Pflanzenwelt Ost-Afrikas, Theil B, p. 290 et Theil C, p. 160. 1895. *Populus euphratica* Olivier, subsp. *Denhardtiorum* Engler in Notizbl. Kön. Bot. Gart. Mus. Berlin, **2:** 217–218. 1898, in Sitzungsber. Preuss. Akad. Wiss. 369. 1904, in Engl. Bot. Jahrb. **36:** 252. 1905; Aschers. in Ber. Deutsch. Bot. Gesellsch. **36a:** 360. 1908. *Populus euphratica* Olivier, var. *Denhardtiorum* Gombocz in Math. Természet. Közlem. **30:** 72. 1908 (Populus-nem Monogr.). *Populus Denhardtiorum* Dode, in Bull. Soc. Dendr. France, **1909:** 152. 1909; Stapf in Hooker, Icon. Pl. **31:** t. 3050. 1916; Skan in Prain, Flora of Tropical Africa, **6,** sect. 2, part 2, pp. 325–326. 1917; Battiscombe, in Descr. Cat. Common Tr. & Woody Pl. Kenya Colony, pp. 66–67. 1926. *Turanga ilicifolia* Kimura in Sc. Rep. Tôhoku Imp. Univ., ser. IV, Biol., **13:** 387. 1938. *Balsamiflua ilicifolia* Kimura, Sc. Rep. Tôhoku Imp. Univ., ser. IV, **14:** 192. 1939.

Ernest Rouleau, Institut Botanique, Université de Montréal

Linum catharticum in Ontario.—A note in Rhodora for March, 1945, called attention to occurrence of *Linum catharticum* L. in New Brunswick and Quebec, the provinces next westward from Nova Scotia, in the eastern parts of which it is well known. An Ottawa, Ontario, collection made by John Macoun on June 15, 1903, "on the left side of the road near the entrance of Beechwood Cemetery", was reported in the Ottawa Naturalist **20:** 164. 1906, by J. M. Macoun; and specimens are preserved in the National Herbarium and in the Herbarium of the Division of Botany, Department of Agriculture, Ottawa, from which a spare plant was recently contributed to the Gray Herbarium. Search for

Photo. B. G. Schubert

ALNUS INCANA: FIG. 1, shoot with foliage and young aments, × 1; FIG. 2, lower surface of leaf, × 10; FIG. 3, inflorescence, × 1; FIG. 4, mature cones, × 1; FIG. 5, half a cone, × 4; FIG. 6, bract, × 10; FIG. 7, nutlet, × 10.

Photo. B. G. Schubert

ALNUS RUGOSA, var. TYPICA: FIG. 1, fruiting branch of the shrub cultivated and naturalized in Germany, derived, presumably, from the original specimen; FIG. 2, venation of lower leaf-surface from same collection, × 10; FIG. 3, half a cone from same collection, × 4; FIG. 4, nutlet, × 10.

Photo. B. G. Schubert

ALNUS RUGOSA, var. TYPICA, native American shrub: FIG. 1, fruiting branch, × 1; FIG. 2, venation of lower leaf-surface, × 10; FIG. 3, portion of cone, × 4; FIG. 4, achene, × 10; FIG. 5, bract, × 10.

Photo. B. G. Schubert

ALNUS RUGOSA, var. TYPICA: FIG. 1, terminal leaves of vegetative sprout of TOPOTYPE, × ?½, after photo. by Professor *Alfred Rehder;* FIG. 2, branches of strictly pistillate shrub, × 1; FIG. 3, typical inflorescence, × 1.

A. RUGOSA, forma EMERSONIANA: lower surface of leaf of TYPE, × 10.

Photo. B. G. Schubert

ALNUS RUGOSA, var. AMERICANA: FIG. 1, fruiting branch, × 1; FIG. 2, bark, × 1; FIG. 3, cones, × 4.

Photo. B. G. Schubert

ALNUS RUGOSA, var. AMERICANA: FIG. 1, foliage and young aments of large-leaved shrub, × 1; FIG. 2, inflorescence, × 1.

Photo. B. G. Schubert

ALNUS RUGOSA, var. AMERICANA, forma HYPOMALACA: FIG. 1, foliage of TYPE, × 1; FIG. 2, leaf of vigorous sprout, × 1; FIG. 3, lower surface of leaf, × 10.
Var. AMERICANA, forma TOMOPHYLLA: FIG. 4, leaf of TYPE, × 1.

Photo. B. G. Schubert

ALNUS SERRULATA, var. VULGARIS, extreme with more acute leaves as in Aiton's type, "foliis obovatis acutis": FIG. 1, foliage of vigorous sprout, × 1; FIG. 2, fertile branch, × 1; FIG. 3, inflorescence, × 1; FIG. 4, old cones, × 1; FIG. 5, half a cone, × 4; FIG. 6, nutlet, × 10.

Photo. B. G. Schubert

ALNUS SERRULATA, var. VULGARIS, extreme with obtuse leaves: FIG. 1, type, × 1, of var. *obtusifolia* Regel; FIG. 2, narrow leaf, × 1; FIG. 3, broad leaf, × 1; FIG. 4, venation of lower leaf-surface, × 10; FIG. 5, inflorescence of staminate shrub, × 1.

Photo. B. G. Schubert

ALNUS SERRULATA, var. VULGARIS, forma NOVEBORACENSIS: FIG. 1, TYPE, × ½; FIG. 2, tip of branchlet with incipient inflorescence, × 1; FIG. 3, fruiting cones, × 1; FIG. 4, lower surface of leaf, × 10; FIG. 5, bark, × 1.

Photo. B. G. Schubert

ALNUS SERRULATA, var. SUBELLIPTICA, all figs. from TYPE: FIG. 1, foliage and incipient inflorescence, × 1; FIG. 2, inflorescence, × 1; FIG. 3, cones, × 1; FIG. 4, fruiting bract, × 10; FIG. 5, nutlet, × 10.

Photo. B. G. Schubert

ALNUS SERRULATA, var. SUBELLIPTICA, forma EMARGINATA, all figs. from TYPE: FIG. 1, fruiting branch, × 1; FIG. 2, largest leaves, × 1; FIG. 3, flowering tip, × 1; FIG. 4, lower surface of leaf, × 10.

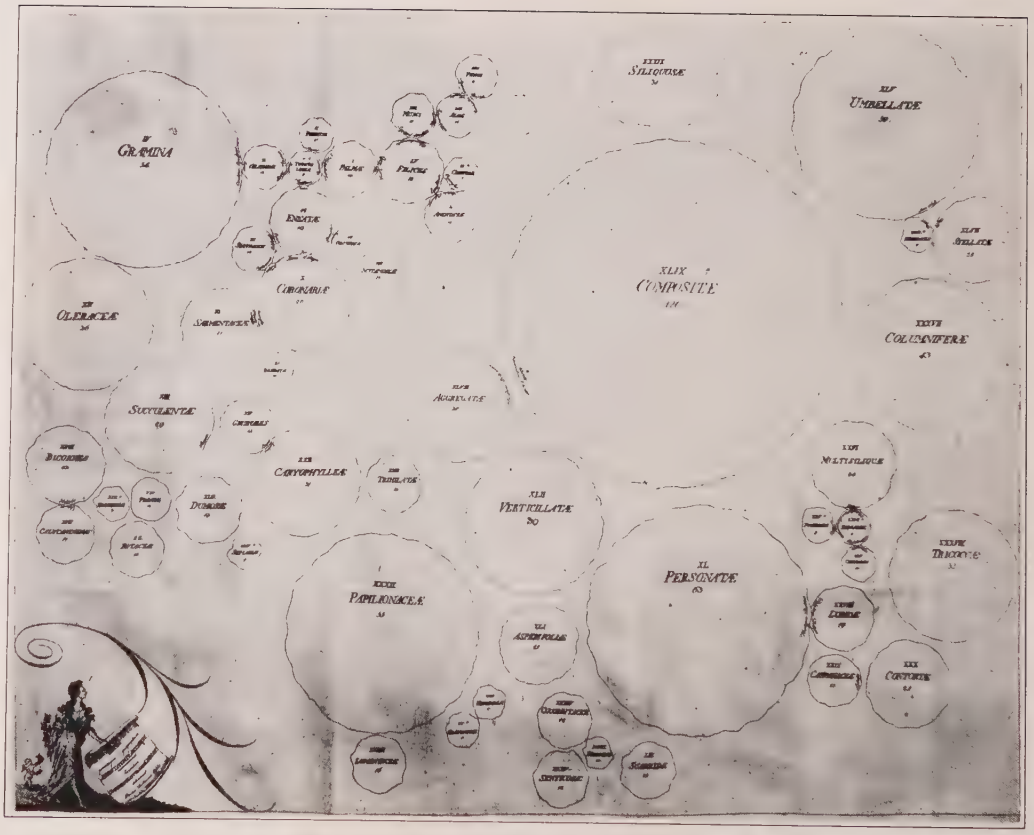
Photo. B. G. Schubert

ALNUS SERRULATA, var. SUBELLIPTICA, forma MOLLESCENS, FIGS. 1–3 from TYPE: FIG. 1, leaf and incipient inflorescence, × 1; FIG. 2, old cones, × 1; FIG. 3, lower surface of leaf, × 10; FIG. 4, unusually long cones, × 1.

Photo. B. G. Schubert

ALNUS SERRULATA, var. SUBELLIPTICA, forma NANELLA, all figs. from TYPE: FIGS. 1 and 2, fruiting branches, × 1; FIG. 3, fruiting cones, × 1; FIG. 4, lower surface of leaf, × 10; FIG. 4, nutlet, × 10.

Euphorbia maculata: left, *Smith & Zimmerman*, Winchester, Massachusetts; right, Plukenet, Alm. t. 65, f. 8.



Tabula genealogico-geographica
Affinitatum Plantarum. Secundum Ordines
Naturales Linnaei delineavit Paulus
Dietericus Giseki
1789

any subsequent reference to a continuing colony, and search in 1945 for such a colony, have failed to locate anything more.

The collection reported for St. Andrews, New Brunswick, July, 1944, by Mr. Weatherby, was not the first from this station. Specimens secured by J. Adams, September 1, 1936, and by H. Groh, July 31, 1936, are in the Divisional Herbarium, but have not been reported.—Herbert Groh, Central Experimental Farm, Ottawa.

ON THE DESCRIPTIVE METHOD OF LINNAEUS

H. K. Svenson

(*Continued from page 302*)

How well Clayton's English notes were translated into Latin by Gronovius, I cannot say. But the English common names did not always fare well, as may be seen by his treatment of the skunk cabbage (p. 186): "CALLA aquatilis odore alii vehementer praedita, radice repente, vulgo **Pole Cadweed**. *Clayt. n.* 17." Clayton undoubtedly had written, at least approximately, "Calla, with creeping root, growing in wet places, with a strong odor of onions, commonly called Polecat Weed." A description was given by Gronovius, but no specific name. The latter was supplied by Colden, and was copied by Linnaeus in *Species Plantarum* (p. 967) as: "DRACONTIUM foliis subrotundis. *Cold. noveb.* 214." On the other hand, the jack-in-the-pulpit received a specific name from Gronovius (p. 186): ARUM *caulescens foliis ternatis*, and his italics show that it was a new name. This was based on Clayton's no. 539, which bore the descriptive note: "Arisarum triphyllum altissimum, spatha & spadice omnino albovirescentibus". Gronovius' specific name was taken up, practically intact, by Linnaeus in *Species Plantarum*, p. 965.[43]

Of the Clayton specimens, Linnaeus saw only the first installment except for duplicates which Gronovius later sent him, or of specimens in the collections of other persons.[44] The assistance of

[43] The Brazilian collection to which Linnaeus refers under *Arisaema triphyllum* came from Canada, and was part of the Burser Herbarium (cf. Juel, H. O. Symbolae Bot. Upsal. II, pt. 1: 5. 1936).

[44] Linnaeus to Bergius (Hulth no. 519), July 2, 1753: "At Beck's I saw a *Ribes* from America, recently received from Gronovius, *pediculis dichotomis*." Clayton also sent some living plants, for Beck (Hulth Letter no. 626) saw *Hamamelis* in London, which Clayton had sent to Catesby.

Linnaeus was chiefly in helping Gronovius arrange the new flora according to the Linnaean method, and in describing some new genera. The situation has in general been so misunderstood that I am quoting (in translation) from the preface of *Flora Virginica* (1739), which was addressed to Clayton:

"I have therefore not hesitated to undertake this work, leaning upon the assistance of our friend, and to examine your gift of specimens (as many as had been up to that time received) with keen-eyed Linnaeus, and to search out the characters of the rare plants which had not been assigned to their genera.[45] I wish that I could recall that learned man [Linnaeus] to examine the remainder of the specimens which you sent me in this and the previous year. After his departure I carried on alone, to the best of my ability, the work of writing up the characters of rare plants; and I earnestly ask you to examine these characters anew in the living plants and to correct any errors which I may have committed.

For certain plants I have given the specific names which are in Hortus Cliffortianus and Flora Lapponica; for the remainder, which had no obvious names, I have myself adapted specific names according to the method prescribed by Linnaeus. For some plants I have omitted names, not sufficiently trusting my own observations; therefore I propose that you examine them for insertion in the second edition of the Flora Virginica which I am preparing.

For each plant I have added as a rule only a single synonym, from which others may be easily found; except for a few plants where synonyms are scattered among various authors and have not hitherto been assembled. Furthermore it will be well to place an asterisk before the names of plants listed in the catalogue of which specimens have not reached me."[46]

As I have pointed out (Rhodora **41**: 521–524. 1939), *Quercus rubra* of Linnaeus included all the American species with lobed and bristle-tipped leaves, and of these the northern red oak was first clearly differentiated by Du Roi in 1772. Much the same is true of *Quercus Prinus* L. This species first appears with a spe-

[45] Melothria, Xyris, Houstonia, Cephalanthus, Claytonia, Pontederia, Prinos, Medeola, Rhexia, Clethra, Hydrangea, Penthorum, Trichostema, Schwalbea, Diodia, Obularia, Chrysogonum, Nyssa.

[46] Cf. also Amoenitates Academicae. Vol. III. n. 31. p. 5. 1751 (L. J. Chenon, sub Praesidii Doct. Caroli Linnaei): "Gronovius, in Flora Virginica (1739 & 1743), enumerated more plants of North America than all others before him; all of which John Clayton, who lived in Virginia, had collected. The illustrious Gronovius examined them, added synonyms, referred them to genera, and distinguished them by specific differentiae." And Jacob Biuur, Amoen. Acad. 3: 388, 389. 1753. "Species Plantarum, which comprises all the species which he (Linnaeus) has treated in his previous works, or later examined, or any that have been collected or described by his associates: as well as those which have been sent to him from all parts of the world, by *Gmelin* from Siberia, by *Sauvage* from Mt. Pessulano, by *Loefling* from Spain, by *Kalm* from Canada, etc. Gronovius has written *Flora Virginica* (1739) in which he enumerates many plants, which Clayton had diligently collected and sent; these he examined, referred them to genera, determined them with differentiae and added synonyms; and in this work no botanist has gone further."

cific name according to the Linnaean method in *Hortus Cliffortianus* p. 448 (1737):

> Quercus foliis obverse ovatis utrinque acuminatis serratis; denticulis rotundatis uniformibus.
>
> Quercus castaneae foliis, procera arbor virginiana. Pluk. alm. 309, t. 54, f. 3. Raj. hist. 1916. Catesb. ornith. 18. t. 18.
>
> *Crescit* in Virginia & Carolina.

This specific name remained unchanged in Gronovius' *Flora Virginica*, and to it was assigned Clayton's specimen. The trees grown in Cliffort's garden presumably came from England, the source of most of the American plants then grown on the Continent. Cliffort's tree had leaves with "denticulis rotundatis uniformibus" as did the Plukenet figure, and through Du Roi (1772) and Marshall (1775) this northern tree has come down to us as "Quercus Prinus" even in Sargent's Silva of North America (1895). Here in a note (vol. 8, p. 53) was the first inkling of the change that was to be made later: "The early description of the Chestnut Oak might apply as well to the Swamp Chestnut Oak (*Quercus Michauxii*) as to this species which does not grow near the coast of Virginia, where, however, the Swamp Chestnut Oak is common, and may have been the first of the Chestnut Oaks noticed by the Europeans". To this may be replied that Banister, who collected much of the early material described by Plukenet, did not lose his life by falling off a mountain on the coastal plain. Many other plants were collected by Banister in the Virginia mountains[47], where *Quercus Prinus* (*Q. montana* Willd.) is abundant. Michaux (Chênes Am. 1801) made *Q. Prinus* into five subdivisions in a peculiar trinomial manner. Of these *Q. Prinus palustris* was based on Clayton no. 77, and *Q. Prinus monticola* on Marshall's species no. 16. This was renamed *Q. montana* by Willdenow in 1805.

In the Linnaean Herbarium in London, which I examined in 1937, there are three specimens of *Quercus Prinus*, all of the

[47] Cf. Ray, Historia Plantarum, Vol. III lib. xxv, p. 6. 1704, "Nux Juglans *Virginiana* fructu minore oblongo. Ex superioribus montosis fluvii inundationibus aliquando defertur, & in rupibus ad praecipitia aut catarractas invenitur." Professor Fernald has written "There is every reason in the world why Linnaeus could have had *Quercus Prinus* (*montana*) and *Q. rubra* (*borealis*, var. *maxima*) from Clayton. They both abound on the lower James River (See Rhodora, xl. 182 & 412). Several later stations were found farther down the James." Changes in application of the names were undoubtedly due to Ashe.

northern tree now frequently called *Q. montana* Willd. Two of these specimens are from Kalm, one of them with staminate flowers; both are labeled "Prinus" by Linnaeus under the number "7", according to the enumeration of species in *Species Plantarum*, and the sheets also bear the number "15". A third sheet (no. 34) bears the label in Linnaeus' hand: "Quercus foliis obverse ovatis, utrinque acuminatis serratis, denticulis rotundatis uniformibus. Hort. Cliff. 448". This specimen, with staminate flowers, has the characteristic shallow crenate toothing of the northern tree, leaves densely stellate-pubescent below, and the winter buds silky tomentose. Nothing is further indicated as to its source. A fourth sheet (no. 20) from Kalm is merely marked "7" by Linnaeus, and was placed under "8" (*Q. nigra*) by J. E. Smith; it is *Q. heterophylla*.

It is advantageous here to discuss other American oaks in the Linnaean herbarium, since they tend to show that the Linnaean species was not based on type specimens, but was rather the subdivision of a genus comprising all specimens, illustrations and descriptions, falling within the differential limits of the specific phrase name.

Q. nigra: sheet 18, "8 nigra K" and sheet 19 "8K" (i. e., both from Kalm). On the latter the number "9" has been written above, and there is the notation "triloba n. 47 det. Smith".

Q. rubra: sheet 21, "K" (*discolor* det. Smith). The lower surface is densely stellate-pubescent. This is *Q. falcata* Michx., or a deeply incised form of *Q. velutina*. Sheet 22: "9" ("discolor H. Kew" det. Smith). The lower surface is densely tomentose-stellate and the upper surface a bit scurfy-stellate. It bears on the reverse side in Linnaeus' hand: "Quercus foliorum sinubus obtusis, angulis lanceolatis seta terminatis integerrimis (vix divisis deleatus et legatus subtus tomentosis)"; i. e., from the Gronovian specific name of *Quercus rubra* the phrase "vix divisis" [somewhat divided] was to be deleted and "subtus tomentosis" inserted. It is probable that this was a modification of the specific name intended for future publication. Sheet 23: "rubra K", a young specimen with staminate flowers from Kalm, determined as *Q. palustris* by Smith, and is that. Sheet 24: "9 K" a mixture of the northern red oak and *Q. palustris* (det. "rubra & palustris" by Smith). Sheet 25: "K" ("*ilicifolia* Willd. no. 59" det. Smith).

Q. alba: sheet 26 "10 K alba". A specimen from Kalm with elongate mature leaves glabrous below, and with very narrow lobes. Sheet 27: "476 Quercus alba". A very young specimen of *Q. stellata* from Gronovius with staminate flowers, lower leaf-surface hairy matted, and the upper with stellate hairs on the veins toward the margin of the leaf. Sheets 26 and 27 are pinned together. Sheet 35: "K"; a single leaf (15 x 12 cm.) of *Q. stellata.*

From the foregoing account of literature and herbarium material, it should be obvious that most Linnaean species consist of two or more species of general present-day usage. Only occasionally, as in *Viburnum dentatum*[48], is it based unequivocally upon a single collection. If the Linnaean *Quercus rubra* is to be rejected because it is based on two or more species of our present interpretation, then the names *Quercus alba, Q. nigra,* and *Q. Prinus* should also be discarded, along with most other Linnaean binomials.

With these preliminary remarks we come to the crucial point in the interpretation of Linnaean species: the relative value of specimens, figures, descriptions and synonyms. It is quite evident that Linnaeus considered the species as an entity which included all these elements. All entities were part of the species and "by knowing any synonym one would know the species". This is true also of herbarium specimens, whether or not they represent the species as we now understand it. *Species Plantarum* was written from a practical point of view, and the fact that Linnaean species were more inclusive, in general, than species of today, does not modify the original status of the Linnaean species.

Thus the statement of Wheeler (Contrib. Gray Herb. n. s. no. 127: 76. 1939), in discussing the identification of *Euphorbia maculata,* that "the identity of the plate is of secondary importance since the specimen in Linnaeus' herbarium takes precedence over cited figures" controverts all Linnaean philosophy, and it is only natural that Wheeler should therefore have found the Linnaean method only chaos. The Plukenet plate has come down through botanical usage and history as the recognized representation of *Euphorbia maculata.* It was based on plants

[48] Cf. Rhodora 42: 1. 1940.

growing in Walker's garden at London as early as 1660 (Plukenet t. 65, fig. 8. 1691). *E. maculata*, in the sense of Asa Gray, has been well known as a European weed (cf. Hegi, Ill. Fl. Mittel-Eur. f. 1757 (1911). Although no scale was given in Plukenet's plate, I believe it to be the generally recognized *E. maculata* (*E. supina* Raf.) because of the following characteristics: 1) it has the reduced axillary shoots very characteristic of *E. maculata*, but rarely seen in *E. nutans;* 2) the leaves are slightly, but definitely, petioled, which is a characteristic of *E. maculata* and not *E. nutans;* 3) the leaves of *E. maculata* are as frequently 3-veined as not, as a casual inspection of herbarium specimens will show. See PL. 990.

There seems to be no reason for Wheeler's change of the traditional usage of the Linnaean *Euphorbia maculata.*

There is nothing in the description, in my estimation, which would discriminate between *E. maculata* and *E. nutans.* It applies equally well to either one. Linnaeus, in the Second Mantissa 382. 1771, merely said: "*Euphorbia maculata* similis *E. hypericifolia*", and nothing more. The treatment in *Species Plantarum* (p. 455) is as follows:

> 21. EUPHORBIA dichotoma, foliis serratis oblongis pilosis, floribus axillaribus solitariis, ramis patulis.
> Tithymalus s. Chamaesyce altera virginiana, foliis crenatis & macula fusca eleganter notatis. *Pluk. alm.* 372. *t.* 65. *f.* 8.
> *Habitat in* America *septentrionali.*
> Caules *dichotomi: Ramis alternis, patentibus, supra purpurascentibus.* Folia *ovali-oblonga, trinervia, subpilosa, serrata, altero latere maxima parte integerrima, tenera adhuc planta notata macula fusca.* Flores *axillares, solitarii, parvi, calyce rufo.*

It will be noted that this Linnaean treatment consists of 1) a new specific name; 2) a synonym; 3) habitat; and 4) a description. Most of the other species of *Euphorbia* treated in the first edition of *Species Plantarum* had been described in the *Amoenitates—Euphorbia maculata* is evidently one of those plants, mentioned in the preface of *Species Plantarum,* for which a description "sine ambagibus" was added.

Since *Species Plantarum* was a compendium based partly on illustrations, there are many instances where pictured material of great similarity in appearance, but representing as we now

understand it, distinct species, was included under the same specific name. Such, for example, were the American *Asclepias syriaca*, based partly on illustrations by Cornut and Clusius[49]; and *Trillium erectum*, based partly on the purple-flowered plant of Cornut's plate (which was said by Cornut to have a white variation), and partly on the once white-flowered specimen of *Trillium grandiflorum* in Burser's herbarium.

Progress of the art of illustration is taken up amusingly, and at the same time regretfully, by Linnaeus in his message to the Royal Academy (Jan. 3, 1765; Fries, Letter no. 367):

"In order that I may further follow the progress of my natural sciences, I observe how the first workers after the *Palingesia literarum* tried to understand the objects of creation, and to illustrate them by descriptions and figures.

"Descriptions were then wrapped up in long and lofty orations; now they have just so many words as are necessary, and without a whipped-cream covering—that is, they are characteristic descriptions which exclude common structures. One no longer says of animals that the head is placed in front of the body, or the eyes in the head, or that a bird has two wings and two feet; or that, in the case of a plant, that the root is dark, the leaves green, the flower beautiful, and that the fruit comes after the flower—one states only the characteristic things.

"Figures provide a similar situation. If I compare the first figures, for example those of Cuba in *Hortus Sanitatis* with Ehret's in *Hortus Cliffortianus*, they appear like ghosts among angels. Figures of the 15th century needed a superscript in order to be understood; they painted a rabbit and said it was a bear. They made figures according to the stories of others, without having seen the object.

"In the beginning of the 16th century the figures were poor, but toward the end of the century they become tolerable, especially after the good masters began carving in boxwood.

"With the beginning of the 17th century, when it was seen that subtle lines could not be cut well in wood, some began to employ copper; at first it went rather slowly and the plates became smudges. But before the century's close appeared Dodart's beautiful figures from the French Academy of Science, not to mention others.

"Even at the beginning of this century, in spite of the fact that the figures had become reasonable enough, one had to get together a whole lot

[49] This plant, the widespread *Calotropis procera* Ait., was brought to Vienna from Jericho by Weixius, and illustrated by Clusius in 1601. This illustration was not unlike Cornut's plant from Canada, and Linnaeus took Cornut's word for their identity. Cornut, Pl. Canad. 1635, p. 89 says: "I here offer a double differentia for *Apocynum:* maius & minus. [These were respectively *Apocynum maius Syriacum* and *A. minus Canadense*, known now as *Asclepias syriaca* and *A. incarnata*]. *Maius* I believe to be the same as Clusius has described under the name *Apocynum Syriaci*. But since a description is lacking and the plant is mutilated (for there is nothing of the root and of its duration, and of the flowers and juice little is known). Furthermore, the learned man states that he has seen the plant only in small dried fragments I have added what seems to be lacking in description."

of synonyms each time a plant or animal was to be determined. One had to get a sufficient library and set up all the citations until naturalists began to paint their objects in lifelike colors, so that one could not possibly be mistaken. I am not speaking of the old illuminated figures which made all leaves the same shade of green, or all yellow flowers the same kind of yellow: but I refer to the Surinam insects of Merian, Seba's paintings, Frischen's birds, Catesby's fishes, Ehret's plants, Roesel's insects, Edward's birds, Regenfus's snails, in which the objects stand as though living, as well as the best portrait painter delineates the human face. Among all these, Roesel is best in the insects, Regenfus in shells, Ehret in plants—all of which are so beautiful that the most stupid Hottentot could stand in admiration and affection for the master's work.

"If I ask, furthermore, what has brought this kind of literature to such a height, I will reply that patronage has been entirely responsible. Wealthy Englishmen supported Catesby's voyage to America, and paid well for his pictures. Roesel was supported by a baron. Ehret's plates brought a guinea apiece, as fast as he could produce them. His Majesty of Denmark's generosity brought us Regenfus's shells. Edward's patron can be read about in his preface. The English boast of Edward, the Germans of their Roesel, the Danes of their Regenfus, and with much reason.

"Our librarians have obtained a new point of view from them; even potentates must stand at the opening of these books, and be drawn into support of the natural sciences. I have tried [unsuccessfully] to get Clerck's figures published . . . This has placed me in wonderment that I, in the 27 years since I returned from my foreign travels, never could command a single good figure. With this help, I, who have had the opportunity of seeing more of our rare plants and animals than anyone else, would surely have brought out some observations quarterly."

It may now be of some interest to trace the progress, or rather the change, of the Linnaean conceptions as they are enunciated in the introductions to succeeding issues of Linnaean works. Many of these were by authors who had lost contact with the Linnaean method, and whose publications merely retained the Linnaean trade-mark, so to speak.

Linnaeus' *Systema Naturae* appeared as a very small publication in 1735. It ran through twelve editions, the last (in 1766) with notes by Fabricius. A number of these editions represented merely translations into other languages, and the eleventh edition is non-existent. The most important were the fourth (by B. Jussieu in 1744), the ninth by Gronovuis in 1756, and the tenth in 1758.

Beginning with the thirteenth (ed. Murray) in 1774, the botanical part was separated out as the *Systema Vegetabilia*, based upon the twelfth edition (1766–1788) of the *Systema*

Naturae. Another edition by Murray appeared in 1784, and this was translated into Italian (as the fourteenth edition) and was also issued with very slight changes by Persoon in 1797. In the meantime Gmelin's edition (which he called the thirteenth) had appeared in 1791, and caught up the names in Walter's *Flora Caroliniana* (1788). The remarkably fine edition (also inscribed as the fifteenth) by Roemer & Schultes required the span of years from 1817 to 1830, and during this interval came the final edition (the sixteenth) by Sprengel in 1825.

In 1817 Roemer & Schultes began their monumental edition of the *Systema Naturae*, and the preface of this work is an extended account of the difficulties which had arisen in the field of systematic botany. It is as fresh and timely today. As they state, Persoon's unsatisfactory edition of the *Systema* had appeared twenty years before (1797). The early death of Willdenow had left his edition (fourth) of *Species Plantarum* unfinished, and the same was true of Vahl and his *Enumeratio Plantarum*. Lamarck's *Encyclopedia*, in process of completion by Poiret, was too large and expensive for ordinary use. The number of species and synonyms since the time of Linnaeus had increased out of all bounds due to the opening up of Australia and America, and the number of herbarium specimens now preserved in various institutions was far beyond the power of any single human being to correlate.

"What (p. vii) was allowed the father of the science is not forever permitted his successors. And for these a new edition either of *Species Plantarum* or of the *Systema Vegetabilia* is necessary for determination of plants: with synonyms not only for species, but for the synonyms scattered about among genera, orders and even classes. From these, new miseries have arisen for even the best botanists of our time. Scarcely half of the plants have been seen that have been collected and described in our time—a burden for many camels—preserved in the museums of London, Paris, Madrid, etc.: so that a man's life would not suffice in comparing and describing either those known or those in herbarium collections . . . For not only are many specimens deceptive, often badly dried or poor in other ways, but even those plants that are living; so that it not rarely happens that excellent botanists have published this or that new species, but later acknowledged it to be only a variety of a species already known. We have omitted genera, since Nature herself has not produced genera; perhaps not even species, you may readily say, if you consider those royal battles of botanists as to what should be considered a species. These arguments could easily be solved, if you would consider as *forms*[50] what they often call *species*—but forms of some importance and

[50] This seems to be the first use of the word "form" in a classification sense, but Roemer & Schultes give no further definition.

easy distinction . . . And what advantage lies in a battle of words, when it is sufficient to know that a plant may have leaves now ovate, or again lanceolate?

"To the diagnoses expressed in an oracular style, as was customarily done in previous editions of Systema Vegetabilia, it seems best for us not to acquiesce. We are persuaded that but few species can be distinguished easily and definitely by these diagnoses alone. We have therefore added short descriptions to the diagnosis, by which the plant can be determined more easily and correctly.

"We (p. ix) have diligently added copious synonyms. The way to enter the sanctuary of truth is to be sceptical in judgment (which we express by the sign '?') . . . If we fail in synonymy there is some excuse in the diverse names published at about the same time by various authors, and the diverse plants published under a single name, and the heteronyms which refer to the same plant under different names. Of synonyms those only are of value by which the plant can be readily and securely known to all botanists. There is nothing in a synonym or a homonym or a heteronym, when a plant—either per se or by fallacious and difficult description or rarity—is dubious, or has been based by its authors on an imperfect figure or description: there you will not rarely find ten or more synonyms. . . If, therefore, you perhaps find the same plant written up under two or even three names in our edition, you should not wonder or be too critical before you have patiently looked through the botanical works of others . . . Who does not detest the enumeration under one name of different plants which have not been seen, or the inclusion of two or three diverse species? By monographs the core of botany will ultimately be reached, so that further doubt may not proceed from the doubtful, and that the abyss will not invoke a greater abyss. We have not dared to change the diagnosis or definition of plants we have not seen.

"All (p. xiii), who may propose new species, are advised to be thoughtful of the future, and to place the new species in its systematic place, indicating its place between species already known, and to which it is most clearly related. We have placed new species at the end of the genus, rather than to interpolate them ourselves."

The Trivial Name

Binomials had appeared sporadically in the publications of Bauhin, Cornut, and others, but not until their use by Linnaeus did they become adjuncts to specific names. The idea itself was one of almost childish simplicity, and the strength of the trivial names lay in the specific phrase names which they represented. It is probable that Linnaean trivial names had their inception in pharmacological terms such as *Sarsaparilla, China, Tacamahacca, Tragacantha*, etc.; it is at least of interest to note that the ordinary Latin adjectives which are often employed as trivial names are not listed in the index to trivial names in *Species Plantarum*, and we may infer therefore that the substantives were considered

as of more importance. As has been pointed out by Sherff (quoting L. H. Bailey; Bull. Torrey Bot. Club **67:** 374. 1940) it would be as logical to have monomials as binomials. This had already been done to some extent by Ehrhart in 1790 (cf. RHODORA **31:** 171. 1929) and such monomials as *Trichophyllum* were taken up by some American botanists and combined as though they were legitimate generic names. Ehrhart was not the only one to advocate the use of monomials, even in limited usage.[51]

Nor was *Species Plantarum* the first place where trivial names were used by Linnaeus. As he says in *Philosophia Botanica* 257: "*Nomina trivialia* may be admitted after a fashion, as I have used them in Pan Suecica; they consist of a single word freely selected from any source.[52] A list of over 800 plants in Pan Suecica bears such names, the method as mentioned by Hasselgren in Amoen. Acad. **2:** 213. 1749 being as follows: "I have arranged the plants of Flora Suecica according to their catalogue numbers; and so that I could study them in brevity, I found it advantageous to add to the generic name a short and insufficient epithet, which is made clear by the Flora itself". An even earlier indication is seen in the italicized second word of the specific name, as in the account of "Radix Senega" issued by Kiernander in the Amoenitates in April, 1749. This paper is perhaps the real genesis of the Linnaean binomial, since in nine

[51] Cf. A. P. DeCandolle, Théorie . . . Bot. 224. 1813: "It is true that the Linnaean method facilitated the study of names; it is also true that it brought to students the possibility of knowing the name of a plant without knowing its character, and thus to place the word for the thing itself. It was without doubt, in accordance with this idea, that Haller rejected specific [i. e., "trivial"] names, but gave great emphasis to descriptive phrases . . . A second inconvenience of the Linnaean nomenclature was to admit the name of the genus as a basis for the name of the species: in effect, genera are very arbitrary, more variable than species; and so, any plant one meets has received four or five names, solely because different botanists have thought that it should be placed in four or five different genera. Therefore, some naturalists, among them Richer de Belleval, Renaulme and Buffon, have thought that it might be more convenient to give each species a single name, so that nomenclature might be independent of classification and not participate in its variations. But this method has been renounced, partly because of the large number of names, partly because there is no aid to memory, and finally because nomenclature itself is a guide to related species."

[52] A. DeCandolle, Lois de la Nomenclature Botanique. 1867. Footnote, p. 7: "What appears to us today to be the most fortunate and the most important of Linnaeus' ideas, seemed to him merely an accessory; for in the editions of his *Philosophia*, all published after 1745, he discourses at length on the phrases (nomina specifica) and merely mentions what we now call the specific names . . . In his dissertation of June 1753, *Incrementa botanices*, in which he considered himself as a reformer in science . . . he did not remark on the employment of binomial nomenclature."

out of ten of the plants (in addition to *Polygala Senega*) which were reputed remedies for rattlesnake bite, the italicized word is taken over directly into *Species Plantarum*. One of these plants was an unidentified plant of Plukenet; the others were *Aristolochia Serpentaria, Actaea racemosa, Prenanthes alba, Veratrum luteum, Osmunda virginiana, Sanicula canadensis, Uvularia perfoliata, Aletris farinosa, Cunila mariana.*

In some other accounts in the Amoenitates, the trivial name, instead of being italicized, was enclosed in parentheses. When it came to writing *Species Plantarum*, Linnaeus placed such names "in the margin", as he says in the introduction to *Species Plantarum*. With an outlook to the future, he continued with the important advice which has been but little heeded, or not at all, "Caveant autem quam sanctissime omnes sani Botanici, umquam proponere nomen triviale sine sufficienti differentia specifica, ne ruat in pristinam barbariem scientia." (All botanists must beware of proposing any trivial name without sufficient differentia specifica, lest the science fall into its original barbarity.) "I have placed the trivial name in the margin so that we may find any plant whatever encompassed by a single name; this I have placed without selection, which however another day may demand."

These trivial names Linnaeus often wrote at the bottom of his herbarium sheets, as has been mentioned in the discussion of *Quercus*. In addition, they were placed by him against some of the polynomials in books in his library, thus [Letter no. 816 (Hulth), Dec. 28, 1753]: "I have written in the trivial names in *Flora anglica* Ray, *helvetica* Haller, *monspeliensis* Magnolii, and a lot of others; and thus the species appear short and clear."

In evaluating the trivial name, Link (Philosophia Novae Prodromus, 1798, p. 190) says,

"Trivial names are now given to all species, a good invention of Linnaeus by which botany is made brief, easy, and secure. It may be a Latin adjective in apposition with the generic name, but as much as possible it should not be a variable character, i. e., color, or even less a country, which is subjected to political changes, and which a species rarely inhabits solely . . . I would prefer some other substantives added to the generic name, either Greek or barbarous, which could be understood by themselves, and would so explain themselves that their significance would not be a cause of trouble. The *subspecies* should be designated by a third name, preferably by an adjective which denotes in what way it differs

from other subspecies; the *variety* not so, but by a brief phrase; and the *monstrosity* not to be indicated by way of name."

With the exception of the work by Roemer & Schultes, the editions beginning with Murray were unimaginative. Johan Andreas Murray, one of Linnaeus' students, set up rules for the formation of the trivial name similar to those used by Linnaeus for the specific phrase-name. To Linnaeus the trivial name was always an accessory. Murray's changes are to be found in the preface of the thirteenth edition of *Systema Vegetabilia* (1774)[53]. They were published with good intentions but undoubtedly led to greater emphasis of the trivial name. Murray notes (p. x) that he has had to change the "character essentialis" of many species, and because of poor descriptions of recent authors was unable to allocate many species within the genus, but was obliged to place them at the end. In changes of the specific phrase-names (p. xvi) he has added the letter "M", not from any feeling of vanity[54], but so that any mistakes that were made might not be attributed to Linnaeus. In the edition of 1784 (and also of 1774?) Murray (p. 8) gives Linnaeus' explanation of the origin of genera and species by hybridization:

"Suppose the Creator, in a progression from the simple to the complex and from few to many, at the beginning of plant life to have created as many diverse plants as there are natural orders. These plants the Creator then allowed to reproduce by crossing so that as many plants arose as there are distinct genera today. From these genera, Nature has through generations without change of flowering structures, mingled and multiplied them into existing species. But to be excluded from this type of generation are hybrid plants which are for the most part sterile. Nature therefore confirms that the Genus is natural."

A *Character*, furthermore, does not constitute a genus, but the character is to be carefully drawn up according to the genus as it occurs in nature . . . The *Diagnosis* of a plant consists in the "affinitate *Generis*" and the "discrimine *Speciei*".[55] The name of a plant, "utramque diagnosis indiget", is to be duplex: a) a *Generic cognomen gentilitium*, and b) a *Specific Praenomen*

[53] Murray states (p. ix) that for two years the younger Linnaeus had promised him the editing of the third mantissa of Species Plantarum, a work which never appeared due to the illness and early death of Linnaeus, the son.

[54] A similar procedure was followed by Reichard and by Willdenow in their editions of Species Plantarum, but no reference was made to vanity.

[55] This statement is somewhat obscure, but certainly different from the Linnaean usage of the term, which applied only to the genus.

triviale, and under this the *Synonyma vaga* of authors. And (p. 9):

"The botanist, following the classification, is led by the character of the plant to a named genus; by the differentiae to the name of the species; thence to its synonyms; from these to the authors, and to all the information that has come to us about the object in question through the course of time. Thus the plant tells its name, and its history among a great multitude of species and individuals; this, the first goal of the botanist, has been brought about during our time, and every true botanist should be absorbed in its perfection".

Miller's seventh edition of the Gardener's Dictionary appeared in 1759. The early editions did not use binomial nomenclature, for Miller, as did Haller,[56] realized the difficulties that would arise from an unrestricted use of the binomials without the concurrent specific phrase name. As Martyn, editing the edition of 1807, says (p. ix):

"[Miller], early and practically versed in the methods of Ray and Tournefort, [was] habituated to the use of these [phrase-names], from his younger years, and it was not without reluctance that he was brought to adopt the system of Linn[a]eus; but he was convinced at length by the arguments of the late Sir William Watson and Mr. Hudson, and embraced it . . . (p. v.)

It is quite evident that Link's observations on the trivial name, especially those dealing with color and geographic locality, were influenced by Murray, who in his edition of *Systema Vegetabilia* (1774) included a supplement with rules for the formation of the trivial name. As he says (Sect. 1): "The trivial name does not render superfluous the definition of a species or the specific differentia; it should however be added whenever in any work there is to be exact determination of plants. Such a necessity exists in the systematic enumeration of plants, in extended designation of either exotic or indigenous species, where there should be some character for comparison, as in medical books or those in plant economy, so that there will not be confusion of species due to lapse of memory or hasty writing". These rules tended to focus attention on the trivial name rather than the specific name, and

[56] Stirpium indigenarum Helvetii inchoata historia. 1768. Introd. p. xxii: "More and more I feel that most genera are artificial, nor can any law be given by which you can determine what discrimination is necessary for separating two genera . . . I have not wished to create trivial names, which Linnaeus and Rivinus have given us, since I realize how meagre several words are, and feel that it would be most difficult to express any characteristic in a single word."

in that respect perhaps tended to hasten the downfall of the Linnaean method.

Varieties

As both Lindman and E. L. Greene have pointed out, Linnaeus was the first to distinguish varieties from species, i. e., at the time of Bauhin there was no distinction between species and varieties, all plants being collected under the genus without further formal designation. Thus the statement of Linnaeus to Cronhjelm "botanists pride themselves on having 20,000 species of plants; but there are not more than 8,000 when varieties have been placed under their proper species". A variant of this statement found its way into the preface of *Species Plantarum:* "Numerum plantarum . . . vix 10,000 attingat". (The number of species in the whole world is much less than is generally credited; I have calculated, sufficiently accurately, that there are about 10,000). The actual number of species in the second edition of *Species Plantarum*, was 7540, and these were distributed in 1260 genera.[57] But it should be emphasized here that the Linnaean species was, in general, much more inclusive than that of the modern consensus.

It is generally accepted that the Greek-letter subdivisions in *Species Plantarum* represent varieties, and this view is corroborated by Linnaean correspondence. For example, in Letter no. 542 (ed. Fries) from Bergius, 1769: "Erica Gnaphalodes n. 27. Your synonym which I placed with this species is probably not the proper one, for I see in the new system that E. Gnaphalodes of Sp. Pl. is placed as a variety under *Erica spumosa.*" It is obvious that the Linnaean "variety" represented the third and lowest stage in the "Genus, Species, Variety" series, and included all the categories below the species, of our modern literature. The low esteem in which Linnaeus held the too liberal designation of varieties may be gained from a letter to Beck (no. 671, ed. Fries, in 1749): "Rosen's flora has 5 or 6 species; the others are all varieties that no one in these times takes the trouble to look for or describe". This statement, and those in *Philosophia Botanica* (section 306)[58], was directed primarily toward the dilet-

[57] Sprengel, K. Geschichte der Botanik. 2: 284. 1818.

[58] "The use of varieties in economics, cooking, and medicine shows the necessity for their recognition in ordinary life; otherwise varieties should not be recognized by botanists unless care is taken that species are not multiplied or confused thereby

tantes or "Anthophili". The idea that the Linnaean variety as employed in *Species Plantarum* applied only to horticultural variations (*varietates levissimae*), or to plants that we would now call "formae", is quite erroneous. Linnaeus tended toward the reduction of varieties (cf. Fl. Suecica, p. ix): "Varieties for the most part I have voluntarily omitted, except for a few which I have placed under their proper species; if, after the manner of some others, I should enumerate varieties in the place of species, I should certainly be able to show more than twice as many plants; I have however judged that the plants themselves and not their mere increase should be considered and I have departed from that custom". That the Greek-letter subdivisions of *Species Plantarum* often have a geographical significance is evident from such examples in *Species Plantarum* as:

Juncus pilosus (p. 329). Habitat in Europae sylvis, at varietates β, δ, ε in Europae australioribus; γ in Alpibus.

Bupleurum angulosum (p. 236). Habitat in Pyreneis. β in Vallesiae alpibus.

Asarum canadense (p. 442). An varietas praecedentis (*A. europaeum*); sic suadet Folia bina, dissuadet alia.

In *Flora Suecica* a similar treatment of varieties based on habitats had been carried out for *Myosotis* (no. 149) and *Gentiana* (no. 203). And in the Amoenitates Academicae **1**: 334. 1743, the paper on *Betula nana* treats the Greek-letter variants as having a significance quite remote from that of cultivated plants. It should be kept in mind, however, that one of the chief functions of *Species Plantarum* was to dispose of the loose-lying varieties of Bauhin's Pinax, and to place them under their proper species; hence the large number of Greek-letter subdivisions under such important cultivated plants as *Prunus Cerasus*, *Prunus domestica*, and various species of *Pyrus*.

The following observations in sections of *Philosophia Botanica* provide a good background for the problem of *varieties:*

158. Varieties are as many as there are different plants produced from the seed of the same species. This is due to accidental causes: climate, soil, temperature, winds, etc. Varieties often revert when the soil is changed.

259. That varieties are distinct species, no sane person admits in the animal kingdom: for there are white cows, black cows, lean and fat cows,

Obvious varieties, in general use, are inserted at the end of the differentiae when necessary."

smooth and wooly cows, and no one has thought that the most diverse represent species.

317. It is as important to assemble varieties under their species, as it is to place species under their genera. The constancy of the older botanists in treating species as distinct, was superseded by the eagerness of more recent botanists (previous to the end of the last century) in augmenting the number of plants and infecting the science by the introduction of varieties as species. This heresy was first opposed by Vaillant, then by Jussieu, Haller, Royen, Gronovius, and a few others, in order that botanical science might not be ruined.

Many varieties can be easily traced back and explained by comparing their variable characters with those of the natural plant; but there are not a few varieties which demand both genius and experiment. The botanist who chooses to occupy himself with varieties can hardly reach his goal—the bounds of interplay of polymorphic nature.

310. *Varietates levissimas non curat Botanicus.* The horticulturists (Anthophili), unremitting in their industry and observation, see in the corollas of flowers marvellous things which the untrained eye cannot perceive; their object is the most beautiful flowers of Tulips, Hyacinths, Dianthus, Primulas, etc. To obscure varieties of these they give names that arouse wonder! They cultivate the science of flowers, all its own and pertaining only to themselves. Into their camp no sane botanist goes.

The technical aspect of varieties, from the modern point of view, has been so extensively discussed in recent literature[59] that little space is needed here. As I have pointed out in a discussion of *Hypericum cistoides*, many of our present varieties have no geographic background, and represent merely random variations in herbarium collections. Moreover we are not certain that some of the variations that we call "geographic" are not responses to climate and soil. The history of subspecies of the ornithologists is quite different from that of the botanists.

The Herbarium

The status of some specimens in the Linnaean Herbarium, especially of the genus *Quercus*, has been discussed. The best general statement on the Linnaean Herbarium seems to be that of C. B. Clarke, the eminent specialist on the *Cyperaceae*, in Journ. Linn. Soc. Bot. **30:** 299. 1894:

"The herbarium of Linnaeus appears to have originally contained a perfect, or very nearly perfect, set of examples (one, two, or rarely more, sheets of each species) representing the Sp. Pl. ed. 1. Each sheet of this set was numbered and named in the hand of Linnaeus, in ink, on the paper

[59] Cf. R. T. Clausen in Rhodora **43:** 157–167. 1941; and C. A. Weatherby in Rhodora **44:** 157–167. 1942. The problem of varieties is also discussed in the outstanding paper by Ramsbottom, Proc. Linn. Soc. London, 150th Session: 192–219. 1938.

itself, the numbers corresponding always to the species-numbers in the *first* edition of the Sp. Pl.

"The herbarium of Linnaeus has been, as is well known, disarranged: a quantity of additional material has been mixed into it; some of the original names have been crossed out; some of the original sheets have been moved, and many have disappeared altogether. There still remain, however, in the Cyperaceae enough of these authentically named sheets to verify more than half the species described in his Sp. Pl. From comparing these so many times, I have come to the conclusion that we possess, in them, in every case, a specimen plant that Linnaeus himself referred to the name he wrote on them. Besides these (usually numbered) specimens there are a good many other sheets named in Linnaeus's hand (but without numbers) which refer to species subsequently published under Linnaeus's names in the Sp. Pl. ed. ii, in the Mantissa, and in Linn. f. Suppl."

And Ramsbottom (Linn. Soc. London Proc. 148th session, p. 26. 1936), in discussing Savage's paper on Burser's herbarium:

"When dealing with the Linnaean Herbarium some botanists seem to have lost their sense of proportion. Great as Linnaeus's opinion of his own work was—with abundant reason—it is foolish to imagine that he could ever have anticipated the importance that future botanists would place on his specimens. Consequently his herbarium was likely to contain some specimens which had been placed with less care than had the majority; moreover, it took many years to accumulate.

"It was common knowledge that all the specimens contained in the Linnaean Herbarium were not types and that all his types were not in his own herbarium; some, for example, were in the Department of Botany [British Museum] in the Hortus Cliffortianus and the Sloane Collections."

Linnaeus notes in the introduction to *Species Plantarum* that Clifford gave him all the specimens that he had in duplicate, and that Gronovius gave him many Virginia plants. In the several volumes of Linnaean letters published by Hulth are references here and there to the herbarium, and of these I quote a few:

No. 767 (to Beck) Jan. 28, 1753: "Take out as many duplicates as you are certain of; then there will be room in the herbarium". No. 61, vol. 2 (to Aymen) May 14, 1753: "You say that you have 6000 *plantas exsiccatas;* I have received plants from nearly the whole world, but have obtained only 6000". No. 1172 (to Celsius) Nov. 1736 (written from Hartekamp, Holland): "Sloane's big collection is wholly in disorder. I got a lot of rare species in England, especially of American plants, such as Sassafras, Canella alba, Alpinia, Barleria, Bauhinia [no.] 6, Bellonia, Bocconia, Breynia, Brunsfelsia, Cameraria, Coa, Cornutia, Dioscorea, Dodonea (mea, non Plumieri), Fuchsia, Hermania (formosissima arbuscula), Jan roja (?), Karatas, Magnoliae 2nd. spec., Mancinella (venenatiss.), Maranta, Petivera, Millera Houst., Kaempferia Nobis, Collinsonia nob., Mollugo nob., Dorstenia Plum., Catesbaea Gronov., Ammania Houst., Triopteris nob., Tetracera nob., Lippia Houst., Dalea Nob., Trigonella nob., Guazuma Plum. &c. Nearly all of them I brought back living to Holland

. . . I am now working hard on Hortus Cliffortianus, which is now up to 300 quarto pages; altogether it will go well over a thousand." Fries has provided the following footnote: "In 1736 Linnaeus visited England, returning to Clifford in Holland in 1737, when he assisted Gronovius on the Flora Virginica. In October he left for Sweden and remained there until the end of February, 1738. He then went to Hartekamp in Holland, which he left in May, 1738; next he went to Paris, and then to Sweden, where he was married in June, 1739."

The "herbarium parvum" was obtained by Alstroemer, who supplied the younger Linnaeus with travel funds. It was composed of specimens from the large herbarium, left at Alstroemer's place in Halland, and eventually came to the museum at Stockholm. (cf. Fries: Biographical Sketch of Alstroemer in Letters, Vol. 1, pt. 3. p. 13. 1909).

No. 968 (to Beck) Feb. 22, 1758: "I have sent 600 thalers to London for Browne's herbarium; I hope it comes intact through the pirates. It certainly must have Rolander's plants". No. 976 (to Beck) July 18, 1758: "Finally I have received Dr. Browne's Jamaica herbarium, which I have been waiting for so long; it contains more than 1000 beautiful plants . . . Here I find all the rare plants which I saw hastily at Rolander's and all that Loefling has described".

No. 440 (to Elvius) Dec. 1773: "I have read through Retzius' paper in which he wants to make 4 species of out *Sophora biflora.* Of this large tree, called *coral-tree,* I have several specimens. As I read through the paper much seemed paradoxical. But I did not wish to trust to my memory, until I came to the country to my collection, which in all ways confirmed my previous ideas . . . The peduncles are usually *biflori;* in poor soil they become *uniflori* . . . and I have specimens which have peduncles *unifloris* et *biflores* on the same branch . . . So I see in this paper nothing which is to be gained, but only more harm, and the placing of 4 species *incorrectly* for one which is certain."

An extensive list of papers dealing with the Linnaean Herbarium will be found in Soulsby's "Catalogue of the Works of Linnaeus" published by the British Museum, 1933, pp. 217–222.

The Natural System

The idea of a natural system interested Linnaeus at an early date.[60] As mentioned in *Philosophia Botanica* (1751, p. 25) a

[60] Spring, p. 5: "The regular arrangement of natural objects under the lowest element of unity [i. e., species] gives us what Linnaeus, for example, called a 'natural system'. But the subjective natural system, as it is set up in the sciences, is quite different from the actual or objective; the latter is an ideal which the former, as much as possible, strives to illustrate."

Spring, p. 6: "The natural system has a double role to fulfill

1) It serves as a register in which each discovered natural object is arranged without constraint, and where each object already named and determined can be placed without difficulty.

natural method had been sought by Royen, by Haller, and by Wachendorff, according to cotyledons, câlyces, etc. The "Fragmenta" of a natural system (p. 27–36) were composed of 67 groups, together with an additional group of plants which were of vague or uncertain status. "This is the first and ultimate desideratum in botany. *Natura non facit saltus.*[61] All plants show an affinity on either side, as a territory in a geographic map. The lack of undetected plants has been the cause of deficiency in the natural system, rather than that the knowledge of many plants has perfected it; for *Natura non facit saltus.*"[62]

Schuster, Nachwort über das Natürliche System. p. civ. 1926, briefly reviews the situation.

"In Classes Plantarum (1738) Linnaeus says that he has worked for a long time on the natural method . . . that he could not complete it within his lifetime . . . and that the key to the system could be given only when all plants had been brought under their natural orders. The natural system must be improved, rebuilt, and completed; those who do so will be the reigning botanists. The principles would be that here no *a priori* rule would suffice, no definite part of the fructification organs, but the integral relationship of all parts". (Schuster notes here that Linnaeus has already seen the principle of the Organism as a Whole). "The relationship of the artificial system Linnaeus explained as follows: the system is for the purpose of determining plants without an instructor. Without a key there is no method for the natural families. But since a key to the natural families is nearly or quite impossible, one can use only the artificial system for identification; the artificial system deals only with the diagnosis of plants, the natural only with the internal character or nature of plants. Who therefore refers to the artificial system resembles a builder who cannot complete the roof of the house. In the last analysis

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2) It should provide us a picture of the plan of Nature, of natural objects in their natural relationships.

The first is the function of the so-called artificial system; the second of the natural system. Completion of the natural system is the most important contribution to Natural History. The better it is done, the more unnecessary an artificial system will become in time."

[61] This phrase had also been used by Ray, Hist. Plant. sig. A_3 verso. "Nam, cum *Natura* (ut dici solet) *non faciat saltus*, neque ab extremo ad extremum transeat nisi per medium . . . (for, *Nature*, as we say, does not make a leap and does not proceed from one extreme to the other, except through intermediaries) . . .

[62] Cf. A. P. DeCandolle, Théorie Elémént. Bot. 1813, p. 45. "Several objections have been made to the system based on a separation contrary to the natural order; but since Linnaeus is the first to have distinguished the natural from an artificial system, he is far from meriting such a reproach. Also whoever examines the [artificial] system sees how relatively certain it is for discovering the names of plants." And p. 59, "The group of imitators of Linnaeus have poorly understood the master and have attributed opinions to him contrary to those he actually held. It is today truly remarkable that those who call themselves Linnaeans are in direct opposition to all the pages of Linnaeus, while Linnaeus and Jussieu were practically in accord on all the principles of the science. Linnaeus was always in favor of the natural system."

Linnaeus' wisdom is a compromise between the unattainable natural and the completed artificial system".

The manuscripts of Linnaeus' student, Fabricius, were issued and edited in 1926 by Schuster [see introductory paragraph of this paper]. In discussing the "chain of nature", Fabricius says:

"Our illustrious preceptor knew how commonly, though erroneously these words were often used, for he was among the first to contend that the affinities of natural objects are many, according to the various relationships observed. Well known is his statement in Phil. Bot. 77: 'Plantae omnes utrinque monstrant, uti Territorium in Mappa geographica'. Should the word 'catena' be employed, it will not be found to be a simple chain, but multiplex and intertwined, and with many free ends which are not connected with other links. On the other hand, the word 'scala' is quite inept. What use I ask, is a ladder, if certain steps are missing, sometimes so many that you cannot make the jump to the succeeding ones? or if after a few steps there may be a huge hiatus to be ascended? Certainly I would not wish to use such a ladder. More apt is the idea of a reticulum (*retis*) of which the substance is disrupted here and there at random. Or to speak without metaphor: into continuous families many plants are joined, each of which has the lineaments of the family, but is otherwise distinguished from the other, as men of the same family in face, stature and approach. Those which are more similar are placed closer to one another, as tribes are joined from families . . . But there are families, in plants as in humans, in which the connection can be seen only as a probability or not at all. Here the network is broken; there it is continuous. The most apt comparison is with a geographic map, where the families of the first group form provinces in their own right, the middle group (which constitute most of the reticulum) form boundaries with these, and those which do not directly cohere form islands. Upon this idea the table has been constructed". [Cf. the appended chart from Giseke's "Praelectiones"][63]. . . .

"Thus, let it be supposed that the mystery of creation was being investigated, and a method imitating nature could be found. Who then seeks the natural method 1) forms *genera,* and these *natural;* 2) having formed these, he examines their convergences and affinities, and then will come the idea of order. For no one will say that Zea and Poa, for example, are of the same genus, though he sees that they are related. He therefore concludes that they are diverse genera of the same order.

"If this method is really natural, the affinities of genera and orders should appear among themselves; thus the natural method should be set up so that the genus or order should be intermediate to the preceding or following genus or order with which it coheres; in this way the chain arises. But such a method cannot be easily shown; for genera are lacking which

[63] Cf. Sprengel, K., Geschichte der Botanik 2: 242. 1818: "Finally Linnaeus appears to have occupied himself studiously with the Natural Method. At least this is shown by his 'Vorlesungen' on the natural families, which he held at his country place, Hammarby, until 1771. (Praelectiones in Ordines Naturales, ed. Giseke, Hamburg 1792)."
See also Sprengel's editions (1809) of *Philosophia Botanica,* Sect. 77: "Fragmenta, quae Linnaeus proposuit, in Praelectionibus a Gisekio editis, haec sunt".

have not yet been detected, which cause a hiatus and a defect in the natural chain, so that order at times may seem to be lacking. Hence anomalies arise, which have an uncertain place in the natural system. But the natural method, though best, cannot be easily discovered; therefore the artificial is to be sought, so that genera can without difficulty be located and distinguished".

The accompanying chart (PL. 991) of the Linnaean natural orders has an ingenuity equal to the phylogenetic charts of the present day, though it bears the inscription, "Tabula genealogico-geographica Affinitatum Plantarum secundum Ordines Naturales Linnaei delinavit Paulus Dietericus Giseke, 1789". The explanation is given on p. 623 of Giseke's "Praelectiones", of which fragments (in translated form) are included here:

"There are provinces (of circles) of which some are merely neighbors while others are contiguous, which I have tried to indicate as clearly as possible. When circles are closely assembled they usually, but not always, indicate neighboring provinces. Thus the first 13 orders are not only as Monocotyledons more closely related to one another than to others, but furthermore even by genera themselves, which are inscribed at the periphery. One of these, the *Palmae*, is related to the Acotyledons; another, the Filices, through *Equisetum*, is related to the *Amentaceae* and *Coniferae*. Thus they are not only neighboring but contiguous. The *Hesperideae* and *Preciae* [*Primula*, etc.] are closely related, but there is no intermediate genus by which they can really be joined. The *Aggregatae*, with seeds solitary and naked, approach the Compositae. . . From the *Compositae* recedes the order of *Umbellatae*, with two naked seeds, but only in degree does it differ in inflorescence (cf. *Eryngium*) . . . Finally, from the *Compositae* the *Columniferae* are not so greatly removed, in the character of the solitary seeds . . . This is the plan of affinity, or GENEALOGY.

"As to the GEOGRAPHIC nexus, the provinces of the Monocotyledons (I–XIII) are sufficiently close. But others are much more distant than can be expressed in the plate. From the *Personatae* to the *Tricoccae* the distance is greater than the map shows. The former probably touch the *Luridae* from which the *Campanaceae* are removed, for there is similarity in the corolla of certain plants (e. g. *Datura* and *Convolvulus*), the number of stamens and pistils, and the similar fruit. With some others, *Campanula lactescens* might seem to make a transition to the *Contortae*. Though many *Tricoccae* have milky juice, none can be combined [with the *Campanaceae*] by means of the fruit. For Linnaeus did not wish to build orders on qualities. Thus there are islands . . . but none of the islands is more remote from other provinces or other islands than the *Siliquosae*. . .

"Finally, as to the amplitude these provinces of islands attain, I have taken the proportion that the number of genera in any order should be a third of the radius of the circle (at the time the map was drawn in 1789, not as in the exposition of orders, in which many new genera from the recent *Genera Plantarum* Linn., ed. Schreber, were added) . . . Thus in the *Stellatae* there are 25 genera, a third of which is 8; therefore the

radius [one-half the diameter] should be four lines long. But if this is carried out in the smaller orders (as those of 10 or 7 genera) the names could not be written in or read, and the radius has been made larger. Such are inscribed with an asterisk. If made on the same scale, the *Compositae* would have taken the whole page, so the proportions are there reduced.

". . . Order XVI is not in the table, because the genera are so few . . . Nor are there any in LIV, of which I did not at all understand the inscription *Miscellanea* until I heard Linnaeus . . . Thus he explained to me: 'Whoever has seen Sarracenia in flower does not question its close affinity with Nymphaea, but at what place can both be put?' I responded that I would associate it with Papaver, on account of the similarity of the stigma of Nymphaea. He replied that he would concede that point, but that plants were lacking which would properly join with the rest of the parts".

The transitional genera between orders are written in fine script on the plate. The orders on the plate, together with the number of genera in each order, the connecting genera and the orders which they connect, are enumerated below:

I. Palmae 10
  Nipa—Filices
  Hydrocharis—Tripetaloideae
II. Piperitae 10
  Acorus—Tripetaloideae
III. Calamariae 12
  Carex—Gramineae
  Scirpus & Schoenus—Tripetaloideae
IV. Graminae 54
  Cenchrus & Cynosurus—Calamariae
V. Tripetaloideae 8
  Butomus—Palmae
  Sagittaria—Ensatae
  Juncus—Calamaria
VI. Ensatae 10
  Ixia—Tripetaloideae
  Crocus—Spathaceae
  Gladiolus—Orchideae
  Iris—Coronariae
VII. Orchideae 11
  Serapis—Ensatae
VIII. Scitamineae 13
IX. Spathaceae 12
  Colchicum—Ensatae
  Erythronium—Coronariae
X. Coronariae 20
  Lilium & Martagon—Ensatae
  Tulipa—Spathaceae
  Amaryllis—Sarmentaceae
XI. Sarmentaceae 21
  Alstroemeria—Coronariae
XII. Oleraceae 36
XIII. Succulentae 29
  Sedum
XIV. Gruinales 14
  Linum—Caryophylleae
XV. Inundatae 10
XVI. Lacking (see note)
XVII. Calycanthaceae 17
  Rhexia—Bicornes
XVIII. Bicornes 23
  Kalmia—Calycanthemae
XIX. Hesperideae 19
XX. Rotaceae 14
XXI. Preceae 12
XXII. Caryophylleae 31
  Lychnis—Gruinales
XXIII. Trihalatae 13
XXIV. Corydales 10
  Fumaria—Rhoeadeae
XXV. Putamineae 8
  Capparis—Rhoeadeae
XXVI. Multisiliquae 24
  Trollius—Rhoeadeae
XXVII. Rhoeadeae 6
  Chelidonium—Corydales
  Sanguinaria—Fumarineae
  Podophyllum—Multisiliquae
XXVIII. Luridae 19
  Pedalium & Datura—Personatae
XXIX. Campanaceae 15
  Lobelia—Contortae
XXX. Contortae 25
XXXI. Asperulae 10
XXXII. Papilionaceae 55
XXXIII. Lomentaceae 10

XXXIV. Cucurbitaceae 12
XXXV. Senticosae 12
XXXVI. Pomaceae 10
XXXVII. Columniferae 43
XXXVIII. Tricoccae 35
XXXIX. Siliquosae 31
XL. Personatae 63
Martynia & Barleria—Luridae
XLI. Asperifoliae 21
XLII. Verticillatae 39
XLIII. Dumosae 19
XLIV. Sepiariae 9
XLV. Umbellatae 50
Sium & Ninsi—Hederaceae
XLVI. Hederaceae 7
Panax—Umbelliferae
XLVII. Stellatae 25
Phyllis—Umbelliferae
XLVIII. Aggregatae 30
Dipsacus & Globularia—Compositae
XLIX. Compositae 120
Capitatae
Sphaeranthus & Echinops—Aggregatae
L. Amentaceae 14
Casuarina—Filices
Betula—Coniferae
LI. Coniferae 7
Cupressus—Amentaceae
LII. Coadunatae 8
LIII. Scabridae 12
LIV. Miscellaneae
LV. Filices 18
Zamia & Cycas—Palmae
Osmunda regalis—Musci
LVI. Musci 10
Lycopodium clavatum—Filices
Hypnum—Algae
LVII. Algae 12
Jungermannia—Muscae
Marchantia & Tremella—Fungi
LVIII. Fungi 11
Agaricus & Peziza—Algae

With this brief account of the Natural Method of Linnaeus, it may be of interest in the nature of a review to insert here what were the last words of Linnaeus on botanical method—the preface to the Second Mantissa, dated September 1, 1771.

"In the twilight of my life I am assembling some scattered accounts and unrecorded observations to add to the First Mantissa. I have emended some *differentia specifica*, where I have seen better or living specimens . . . Dubious synonyms, formerly admitted, I have often excluded here; for not in many synonyms, but in true specific differentiations lies the strength of the art. The new species of many authors I would gladly have inserted, if the essential characters had been included, but with these lacking I was obliged to omit plants which I had not seen myself. Some botanists talk loudly about the *Natural Orders* in place of a method, but so long as there is no essential character of an order, by which the genera can be combined or distinguished from those of different orders, these orders remain as a bell without a clapper. However, their use in other respects may be of the greatest importance.

"If anyone after my time should publish my *Systema*, *Genera*, or *Species*, I beg him to insert in its proper place, each of the plants that I have noted in the Mantissae, Systema, and the various appendices. If he should wish descriptions of species he will find them in *Hortus Cliffortianus* and *Hortus Upsaliensis*, in *Flora Suecica* and *Flora Zeylanica*, in the *Amoenitates* and in my *Travels*".

Resumé

Not until Redi had disposed of the doctrine of spontaneous generation, and Harvey had shown the continuity of life from the egg, was it possible to place species on a firm basis, i. e., immutability, and to observe that "there are as many species as were

created in the beginning". The doctrine of immutability of species from the beginning was to give way later in Linnaeus' life to the idea that existing genera and species had been derived by the crossing or hybridization of a few created forms. As early as 1733, Linnaeus had outlines of his chief botanical works: Bibliographia Botanica, Philosophia Botanica, Genera Plantarum and Species Plantarum. The last-named work (1753), the basis of modern nomenclature, may be looked upon as a revision of Bauhin's "Pinax" in which the unit of classification was to be the *species;* whereas in Bauhin's work the *genus* was the unit of classification. Binomial nomenclature, as used in Species Plantarum, consisted of the *genus* and a *trivial* name, the binomial to be used as a supplement to (but not a replacement of) the polynomial specific name. Treatment of the genus (*Genera Plantarum*) was in three stages of amplification: 1) the *natural character,* essentially a description; 2) the *factitious character,* a few notae sufficient to distinguish genera in an artificial order; and 3) the *essential character,* a single unusual character sufficient for recognition. The goal, as in modern times, was to find the *character essentialis.* At the time of publication of "Species Plantarum", both genera and species were considered by Linnaeus to be "natural"; i. e., they were created units, and it was the duty of man to group together those species which belonged to a genus. According to Linnaeus: "*All genera and species are natural:* unless this principle is assumed there can be no soundness in the art". This point of view was strongly opposed by Lamarck who considered all genera as artificial.

As Spring and others have pointed out, most of our genera are not natural units; but merely represent a stage of classification above that of the species. Nor did the doctrine of descent with modifications of Lamarck and of Darwin ease the Genus problem, since it introduced the additional element of time into a system which had been preeminently concerned with the nomenclature of plants and animals as they are distributed in space. To this problem of the Genus, Linnaeus seems to have given a good answer: "The limits of a genus cannot be determined until all the species of the genus are known". In the author's opinion, the attempt to make all genera "natural", without some conventional limitations, would be destructive to nomenclature, which is built up primarily on a basis of history and usage.

"The Ariadnean thread of the systematists terminated in Genera, but I have attempted to extend it so far as Species, for which I have made proper differentiae". As in the treatment of the Genus, there was also a threefold aspect of technical delimitation: 1) The *Descriptio*, or *character naturalis;* 2) the *Nomen Specificum*, or polynonial phrase-name, based on differentiae taken from the *Descriptio;* 3) *Nomen specificum essentiale*, in which only a single character (*nota*) was present, and which constituted the goal of differentiation in species; but most Linnaean specific names remained in the *synoptic* stage, where several characters (*notae*) were still required for differentiation. The trivial name was placed "in the margin" in *Species Plantarum.*

The polynomial phrase name (specific name) required changes when it was converted from a synoptic to an essential name; also changes were usually necessary in adjacent specific names when a new species was introduced into the genus, in order to balance the differentiae; new specific names were required when pre-Linnaean and other specific names without differentiae were introduced into the Linnaean system. These older specific names became synonyms.

The Linnaean species appears to have been an aggregate of the synonyms, illustrations, herbarium specimens and living plants noted in the gardens at Upsala and elsewhere. All synonyms seem to have been of equal value, since "by any synonym you can know the species". The Linnaean species, therefore, included all material encompassed by the specific name. Distinctions were not so closely drawn as at the present day, and in general each Linnaean species consisted of several species, as delimited by modern consensus. Illustrations played a large part in Linnaean procedure. Specimens were placed in the herbarium as representative of the species, but were frequently discarded or replaced. Selection of a representative element for each Linnaean species, would seem largely dependent on usage.

The Linnaean natural system as it was conveyed to his student, Gieseke, is shown in graphic form, with explanations.

The writer is greatly indebted to Mr. C. A. Weatherby for a number of suggestions made after reading the manuscript, and to Mr. W. L. Dix for his help in translating the Latin of the preface of Roemer & Schultes' *Systema.*

Brooklyn Botanic Garden

CHRYSANTHEMUM ULIGINOSUM PERS. ADVENTIVE IN QUEBEC.—Late in the season of 1939, while botanizing in a once-abandoned cow-field in Lachine, a suburb of Montreal, the author came upon what first struck him as an odd, if not extremely robust, form of the "ox-eye daisy". The short-stalked flowers, which occasionally were severally grouped together, though somewhat larger, closely resembled those of the weed species of the genus *Chrysanthemum*. At the same time, however, it was striking to observe that in the older heads, the yellow ray-flowers had turned dark brown. The erect, shoulder-high stems were well covered with light green foliage, the long-lanceolate, acutely-pointed leaves of which were regularly as well as sharply toothed. Owing to the author's unfamiliarity with the following variety, it was originally determined as *Chrysanthemum Leucanthemum* var. *pinnatifidum* Lecoq & Lamotte. A comparison, last summer, with the various species of *Chrysanthemum* grown here at the Montreal Botanical Garden, revealed that the material on hand was good *C. uliginosum* Pers., which some botanists keep in a genus apart, *Pyrethrum*. Dr. L. H. Bailey's observation (Standard Cyclopedia of Horticulture **1**: 758. 1939) that this native Hungarian species "deserves a greater popularity" increases the interest in this plant as a garden escape.

This may be the first record for Quebec though it is not the first time that the giant daisy has been mentioned as having become established outside of a garden. Last November, Mr. C. A. Weatherby informed the writer by letter that there was but a single American specimen of the species at the Gray Herbarium. It bears the data: "A plant on roadside with *Boltonia asteroides*, probably dumped, Lenox, Berkshire Co., Massachusetts, Sept. 9, 1919, R. Hoffmann". He also mentioned that two localities in Connecticut, New London and Woodbridge, were given in the paper on "Additions to the Connecticut Flora" (Bull. Conn. Nat. Hist. Survey **48**: 90. 1931).

Dr. G. L. Wittrock, Custodian of the Herbarium, states that no specimen of *C. uliginosum* collected in the field is housed at the New York Botanical Garden.

The giant daisy has not spread elsewhere in Lachine but has remained localized in the spot where the author first collected it on October 9, 1939. It now seems firmly well established in a

moist depression in this cow-pasture, growing along with *Ranunculus acris* L., *Galium palustre* L., *Scirpus atrovirens* var. *georgianus* f. *viviparus* Vict. together with some other plants less exacting in habitat-requirements, such as *Pastinaca sativa* L., *Lithospermum officinale* L., *Solidago rugosa* Mill. and *S. canadensis* L. It now forms an almost perfectly circular patch, some six feet in diameter, with the number of plants densest about the circumference and gradually thinning out towards the center. The plant, in all likelihood, may merely have been dumped there.

The original collection has been deposited with the Herbier de l'Institut Botanique de l'Université de Montréal. Duplicates of material collected on a subsequent trip to the station on September 28, 1943, have been forwarded to the Gray Herbarium of Harvard University for checking.

The author desires to express his sincere thanks to Messrs. Weatherby and Wittrock for their generous assistance, as well as to Mr. Marcel Raymond, of the Montreal Botanical Garden, for several valuable suggestions.—James Kucyniak, Montreal Botanical Garden.

Chamaedaphne calyculata (L.) Moench, var. **latifolia** (Ait.), comb. nov. *Andromeda calyculata*, β *latifolia* Ait. Hort. Kew. ii. 70 (1789).

Typical Eurasian *Chamaedaphne calyculata* has the oblong to oblong-lanceolate leaves mostly 2.5–5 cm. long, about one third as wide, its calyx-segments broadly deltoid-lanceolate to narrowly deltoid-ovate and acuminate or nearly so, these a third to half as long as the urceolate corolla. The common North American shrub, similar to the Eurasian and up to 1 m. or more high, has the leaves one fourth to two fifths as broad as long, the acute calyx-segments about one third as long as the nearly cylindric corolla. This is var. *angustifolia* (Ait.) Rehder.

Var. *latifolia* was described by Aiton:

> β corollis oblongo-cylindricis, foliis oblongo-ovalibus obtusis . . . *Nat.* . . . of Newfoundland.

All the specimens from Labrador and most of the many collections from Newfoundland have the oblong or oblong-elliptical leaves broadly rounded at summit and only 1–3 cm. long, only

about twice as long as broad. Furthermore, the calyx-segments are broad- to roundish-ovate and blunt, often quite obtuse. This shrub, often depressed and down to only 1 dm. high (up to 6 dm.), is clearly what Aiton had. It occurs from the Labrador Peninsula south, somewhat locally, to Nova Scotia and northern New England, the commoner shrub of the latter regions being var. *angustifolia*.

It is probable that *Chamaedaphne calyculata*, var. *latifolia* is *C. calyculata*, var. *nana* (Lodd.) Rehder in Bailey, Stand. Cycl. Hort. ii. 732 (1914). However, *Andromeda calyculata* β *latifolia* Ait. (1789) greatly antedates *Andromeda calyculata nana* Lodd. Bot. Cab. ix. no. 862 (1824); and Loddiges, although giving a good plate, had no description which can be taken as diagnostic. Instead he wandered over the subject, including a sermon, without getting down to a concrete description:

> This neat little variety is a native of North America: it is evergreen, and seldom grows above half a foot from the ground. It flowers with us in the month of March, being one of the earliest shrubby plants that we are acquainted with.
>
> It is quite hardy, and may be increased by layers, thriving best planted in a mixture of peat earth and loam in a border. Care should be taken to place such dwarf plants in situations where they may be seen to advantage. It is thus even in matters of far greater importance, and such as are connected with our highest interests, for (to use the words of an excellent writer,) 'Much of the credit and comfort of Christianity is lost in consequence of its professors fixing their aims too low, and not conceiving of their high and holy calling in so elevated and sublime a view as the nature of religion would require, and the word of God would direct.'

M. L. Fernald

A new Form of Campanula from Minnesota.—Campanula rotundifolia L. var. intercedens (Witasek) Farw. forma **cleistocodona,** f. nov., flores erecti, steriles; corollae inflatae, clausae.—Minnesota: a colony restricted to a single fissure of diabase, southwest end of Beaver Island in Lake Superior, 2 mi. east of Beaver Bay, Lake Co., Aug. 14, 1944, *Lakela* no. 5777 (type in Univ. Minn. Herb.) Lab. grown spec. no. 6133.

The form herewith described appears to be a natural clone capable of maintaining itself by vegetative propagation. Moreover, it differs from the typical form by erect, sterile flowers, inflated corollas closed at the mouths.

To confirm field observations of its flowering habit by experimental study, the writer collected from the fissure on Beaver Island young plants with basal leaves on May 26, 1945. The potted plants grown under laboratory conditions showed notable vigor. During the period of anthesis, from the latter part of June till the middle of Sept., over fifty flowers were produced by the six plants. Not one of the flowers opened its corolla-lobes.

In about a month the first formed flower-buds were as large as those of the typical form at the time of the opening of the corolla-lobes. In the typical form, also grown under laboratory conditions, the lobes expand while the limb of the corolla is still plaited in at the sinuses, exposing the dehiscing anthers and the elongating style. In the clone, the anthers dehisced within the closed corollas, coating the styles with copious pollen. At this time nectar was notable. Then the corollas gradually inflated into pyriform balloons within which the stigmas matured but the styles failed to elongate. At that time the pollen was post-mature. Without deflation the corollas dried up on infertile withering ovaries.

The laboratory observations are in full accord with those of the field study at the time of the discovery of the colony and three later collecting trips. In the particular crevice, the *Campanula* with erect, air-filled, balloon-form flowers presented a startling contrast with the typical form, growing in abundant clusters in the adjacent crevices of the same rock ledge. The colony was last observed on Sept. 6, 1945. The fissure was well filled with stolons and basal leaves; in post-anthesis the withered but inflated bells were fruitless.

In drying the specimens at least some of the flowers popped open from pressure; on boiling the pressed specimens open.—Olga Lakela, Duluth State Teachers College, Minnesota.

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